ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

Vol. XXXIV, No. 3.

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The electric conduit railway on Lenox Ave., New York city, about two miles in length, was opened to traffic on July 9. The line begins at Columbus Ave. and 108th St. and ends on Lenox Ave. and 146th St. The system used was described and illustrated in our issue of March 21, and consists of a continuous double conductor of channel-irons suspended in the conduit. The road has been built by the General Electric Co. for the Metropolitan Traction Co., which is especially desirous of introducing some form of mechanical traction on its numerous cross-town roads, where the traffic is too light to warrant the heavy first cost of a cable line, with the many crossings and curved alinement required. New York still has nearly 100 miles of street railway operated by horses, and some 6,000 horses are still at work on street car service in the city.

The Waterloo & City Electric Railway, in London, now under construction, is intended to enable passengers to reach the heart of the City from the London & Southwestern Ry. terminal at Waterloo. With a speed rate of 22 miles per hour, passengers can be landed at the Mansion House in 4 minutes. The departure station at Waterloo is about 36 ft. below the railway tracks, and the landing at the Mansion House is 65 ft. below the street surface, with lifts provided at the latter point. The line crosses under the Thames about 500 ft. above Blackfriars Bridge, on the Surrey side, passes under the river obliquely and then follows the center of Queen Victoria St. to its terminus. The total length of the line is 1⅛ miles and the two tracks will lie in two separate circular tunnels. These are now being driven by compressed air and a shield, and 1,600 ft. of one and 1,400 ft. of the other tunnel are completed. The engineers are W. R. Galbraith and J. H. Greathead, with Mr. H. H. Dalrymple as resident engineer.

The old East River Bridge Co., through its President, Mr. Frederick Uhlmann, offers to sell to the Commission charged with the duty of constructing a bridge on behalf of the cities of New York and Brooklyn its franchise for constructing a bridge across the East River for $200,000. It would include in this transfer real estate valued at $22,500 and $53,000 cash in bank. It requires, however, that the Brooklyn Elevated Ry. shall have the right to run its trains over the bridge. Without this latter provision they would still make the transfer, if desired; but would demand a larger sum. It is not at all certain that the Commission will entertain any proposition for purchase, as the charter of 1895, under which it acts, has no reference to the charter of 1892, under which Mr. Uhlmann and his friends attempted to build a bridge.

A contractor's suit of some interest is that brought by John J. Radly & Co. against Boehm & Coon, owners of the Diamond Exchange, 14 Maiden Lane, New York city. According to the press reports Radly & Co. constructed the iron work of the building and hold a mechanics' lien against it for the amount sued for. Boehm & Coon assert that the building was examined by experts and found to be some 11 ins. out of plumb, owing to the faulty construction of the iron work, and they have put in a counter-claim against the plaintiffs for $53,000, alleging that they have been damaged to that extent by the defect. The building was practically blown out of plumb during a storm in October, 1893. The construction of this building and the methods employed for straightening it were described in our issue of May 24, 1894.

The decision of the Montreal Bridge competition is still delayed by the absence of the Managing Director of the company, Mr. C. N. Armstrong, in London, according to a letter received by us from Mr. H. C. Wurtele, the Secretary of the Montreal Bridge Co., under date of July 12. The plans received have not yet been submitted to the examining engineer. On Mr. Armstrong's return, which it is expected will be before the end of the present month, we are assured that the matter will be taken up.

The system of sinking foundation caissons now being used by the Hydraulic Construction Co., of 145 Broadway, New York city, for the foundation of the 16-story Johnston Building, on the corner of Broad St. and Exchange Place, is said to have never before been used for the foundations of buildings. It is the recent invention of the General Manager, Mr. William D'H. Washington, Assoc. M. Am. Soc. C. E., and consists, briefly, in sinking open steel cylinders by the use of water jets issuing from hollow castings bolted to their lower edges. The cylinders in this case are about 27 ft. long and from 6 to 13 ft. diameter, according to the load which the contained foundation has to support. They are heavily weighted and sunk through a stiff quicksandy soil to rock, 40 ft. or more below the sidewalk, in from two to ten hours each, the contract requiring the full number of 44 caissons to be sunk in 50 working days. The interior of each is then excavated, a concrete bottom put in, and the remainder filled with brick masonry to the level of the grillage supporting the column. The total weight on the foundations is nearly 30,000 tons, varying from 342 to 1,044 tons per column, and the cylinders are proportioned to give a pressure of about 13½ tons per sq. ft. on the brickwork and about 15 tons per sq. ft. on rock. The Johnston Building is being erected by Mr. Charles T. Wills, Builder, under the direction of Mr. James B. Baker, Architect. Mr. H. Waller Brinckerhoff, M. Am. Soc. C. E., has been retained by this company as consulting and supervising engineer on the work.

Bids for making test borings for a new lake tunnel for the Chicago water supply will be received until July 24 by Mr. W. D. Kent, Commissioner of Public Works. It is said that the north shore inlet tunnel will be extended about one mile, and that bids will also be asked for new pumping engines and boilers.

The second attempt to devise a plan for founding a lighthouse on Diamond Shoals, off Cape Hatteras, has resulted in failure, according to Washington news items. Last fall heavy iron piles were fitted down into the sand, and a quadrangular experimental pyramid was erected upon them to test the wave action. A recent inspection shows that the superstructure is completely demolished, and the piles that remain are twisted into corkscrews. Below the sand surface the piles seem to be all right, but the experiment seems to demonstrate the fact that no structure founded upon piles can withstand the destructive action of the waves.

The Washington aqueduct tunnel is to be tested for leakage under a Congressional appropriation of $25,000 for that purpose. The three intermediate shafts are now being closed by masonry, and before the test of the incomplete lining masonry can be made, nearly 10,000,000 gallons of seepage water will have to be removed. The report upon this test is not due until Dec. 2, 1895.

A large masonry dam to develop electrical power is reported as projected near Toronto, Ont., by the Georgian Bay Ship Canal & Power Co. It is said that the dam will be built across the Humber River, about 1½ miles above its mouth; that it will be of masonry, 120 ft. high, 80 ft. thick at the bottom, 20 at the top, 444 long at the base and 838 ft. at the crest, containing 110,000 cu. yds. of masonry, the rock for which will be quarried near by. It is estimated that some 10,000 HP. will be provided by this dam. The company is reported as having other projects, including the development of more water power at various points, and the construction of a navigable canal from Toronto to Georgian Bay. Mr. Peter Ryan, presumably of Toronto, is said to be one of the vice-presidents of the company.

Electricity generated by a water power plant at the falls of the American River, at Folsom, Cal., is now utilized for lighting, driving street cars, etc., at Sacramento, Cal., 25 miles from Folsom. A masonry dam has been built across the river, and the water from the reservoir thus formed drives four 30-in. turbines under a head of 55 ft. The wheels develop 1,300 HP. each, and are coupled direct to four General Electric Co.'s alternating current generators of 1,000 HP. each. The plant was described in our issue of April 11, 1895.

The electric locomotive of the Baltimore Belt Ry., illustrated in our issue of July 11, hauled a load of 26 freight cars and two steam locomotives through the tunnel on July 16. The train load is said to have been 1,400 net tons.

The Woronoco Street Railway Co., of Westfield, Mass., which has been experimenting with the Mekarski compressed air cars for some time, has decided to adopt the overhead wire electric system.

Compressed air cars are to be tried in New York city, on the Ninth Ave. line of the Metropolitan Traction Co. Mannesmann steel tubes are to be used for the air reservoirs.

The most serious railway accident of the week was the wreck of a fast mail train on the Illinois Central R. R. at Ponchatoula, La., July 11. A locked switch had been opened by wreckers and the train ran onto a siding, where it collided with a train of empty coal cars. The engine and baggage car were upset, but the rest of the train kept the rails. The engineman was killed and the fireman badly injured.

Two serious electric railway accidents have been reported recently. On July 13 two cars of the Toronto & Scarboro Suburban Ry., Toronto, Ont., collided while running at high speed, with the result that one person was killed and five were injured, two fatally. On July 8 a car at East Liverpool, O., ran away on the Franklin Ave. grade, jumped the track at the crossing of the Cleveland & Pittsburg R. R. and went down a 15-ft. bank. One man was killed and 18 more or less injured.

The sidewheel steamer "Cibola," running between Lewiston, N. Y., and Toronto, Ont., was burned at the wharf at Lewiston on July 14, the third engineer being killed. The steamer was built at Glasgow, Scotland, and was 255 ft. long.

A fire occurred in one of the cargo compartments of the French Line steamer "Normandie" on its last trip to this port, but it was extinguished before it had assumed very dangerous proportions.

A portion of the second floor of the old Casino at Atlantic City, N. J., gave way July 10 when crowded with people, and about a hundred persons were more or less injured, but nobody was killed, as the floor gave way slowly at the middle, and slid the people into a heap on the first floor 20 ft. below.

A sewer trench at Scranton, Pa., caved in July 8, and caused the bursting of a water main, so that the trench was flooded. One man was killed.

The caisson for the foundation of a large bridge being built by a French company, near Alexandria, in Egypt, is said to have collapsed or been blown out on July 9, causing the death of 40 men.

A cofferdam is being built at Bath, Me., intended to be used in changing and adjusting the propellers of the ram "Katahdin." This dam is 40 × 50 ft. in plan and 23 ft. deep. One end is cut out to exactly fit the contour of the hull, and the edges are cushioned with 2 ins. of felt to make a tight joint. When it is to be used it will be sunk by water-ballast sufficiently to be slid under the hull, and when the water is pumped out again the upward pressure will be depended upon to keep the joint water-tight. The purpose of this dam is to avoid the possible straining of the heavy ram in the drydock available, and to permit as frequent and accurate adjustment of the new propeller blades as may be required.

The plans for the six light-draft, composite gunboats, for which the late Congress appropriated $230,000 each, are completed, and proposals for building are called for by the Secretary of the Navy. Four of these boats will have considerable sail power, in addition to steam, and two will have military masts only. They are especially designed to protect the crew from musketry fire, and the main portion of the battery is housed in an unbroken deck; but the bow and stern guns necessarily remain unprotected, owing to the required arc of fire. The vessels with sail power will have single screws, and the other two twin screws. In all cases the armament will consist of six 4-in., four 6-pdr. and two 1-pdr. rapid-fire guns. The principal dimensions of these gunboats will be as follows:

| | Single-screw type. | Twin-screw type. |
|---|---|---|
| Length on load water-line..... | 168 ft. | 174 ft. |
| Extreme beam water-line..... | 36 " | 34 " |
| Normal draft, to bottom of keel.. | 12 " | 12 " |
| Normal displacement, about..... | 1,000 tons | 1,000 tons. |
| Indicated horsepower, about..... | 800 | 800 |
| Speed, in knots per hour..... | 12 | 12 |

The covering of the filter beds connected with the water supply of Lawrence, Mass., is reported as under consideration by the water board of that city. The beds have an available filtering area of 2½ acres.

## ELEVATED STRUCTURE, MERCHANTS' BRIDGE TERMINAL R. R., ST. LOUIS, MO.

(With Inset.)

By H. P. Taussig, M. Am. Soc. C. E.

The elevated structure recently built by the Terminal Railroad Association of St. Louis is illustrated in the accompanying cuts, which show some typical details of the work. This structure is practically an extension of the elevated work built by the Merchants' Bridge Terminal Ry.,* some years ago. The latter work ended on the south side of the extensive freight terminals in the Mill Creek Valley. The tracks of the Terminal Railroad Association lie on the north side. The present structure was built to bring the Merchants' Bridge lines to a connection with the tracks of the Terminal Railroad Association. In conjunction with the Merchants' Bridge elevated work, it gives to all lines using either the Merchants' Bridge or the Bellefontaine Bridge an unobstructed entrance into the new Union passenger station opened last September.

The structure is located in one of the busiest sections of St. Louis. As shown on the plan and profile, it crosses the freight houses and tracks of the St. Louis & San Francisco R. R. and the Missouri Pacific Ry., curves over the tracks of the Terminal Railroad Association, and thence descends, by a temporary wooden trestle, to a connection with the latter, between the inbound and outbound main tracks leading from the Union station to the Eads Bridge. This arrangement avoids any grade crossings between the main tracks. The general location, alinsment and grades had to conform to rigid local conditions.

The tracks are on reverse curves of about 12° and 10° respectively, separated by 150 ft. of tangent, with spiral easement curves about 200 ft. long on each end of the regular curves. The centers are spaced 12 ft. 6 ins. on tangent and spread to 15 ft. 6 ins. on curve to obtain clearance for the through girders. The use of the easement curves not only gives a uniform increase in the curvature of the track and a corresponding increase in the elevation of the outer rail, from tangent to full curve, but, by making the easement curve for the inside track longer than for the outside one, it also gives a gradually increased distance between track centers. The grades on the south and north part of the iron work are 1.3% and 1.2%, respectively, and are rounded off near the center by a long vertical curve. The wooden trestle on the north end is on a temporary 2% grade, which was found necessary to give headroom under the existing city viaduct on 12th St.

The work is double track, plate girder construction, partly of through girders and partly of deck girders, the latter being used where the headroom is sufficient. The spans vary from 21.5 to 74.3 ft. in length. The longitudinal girders rest on top of the cross-girders and posts and are riveted to them, except at expansion points, which are provided at every alternate bent. The girders are rigidly braced by the usual lateral bracing of angles and gusset plates. The position of the bents and location of the posts were governed by the existing tracks and teamways underneath. As will be seen on the plan, this placed all but the last bent on a skew with the line of the structure. The angle of skew varies from 43° to as much as 63° and is different in nearly every case.

Each post is built of two 24-in. I-beams, reinforced by 8-in. flange plates of varying section and length, and fastened together by plates and lattice bars. The posts are braced in the plane of the bent by stiff angle bracing, as shown on the drawings. In the other direction ordinary bracing was impracticable. The necessary clearance and headroom prevented any direct connection between posts, and the amount and variation of skew made any gusset plate or knee-brace attachment to longitudinal girders ineffectual and inexpensive. The necessary stability was obtained by rigidly anchoring the posts at the base and proportioning them for the combined bending and direct stresses.

The anchorage consists of rods from 2½ ins. to 3½ ins. in diameter, not upset, and 12 to 18 ft. long. The rods are anchored in the foundations in pairs by means of special cast iron washers bearing on top of the hitch angles. The latter are 7×3½×⅝ ins., about 3 ft. long, and securely riveted to the flanges of the post in pairs, forming pockets for the rods.

Great care was taken in the design and execution of the details of the anchorage, so as to develop the full strength of the rods. The latter were accurately spaced by iron templates and set plumb in the foundations. The nuts on the rods, the plate washers and the hitch angles on the post were all faced to insure a true bearing. The posts were set on ½-in. wedges until the structure was adjusted and riveted. After this, the space between post and cap stone was solidly packed with rust joint filler before the nuts on the anchor rods were brought to a bearing. This rust joint filler, if made of cast iron borings effectually molds itself to any irregularities of surface in the capstone or base plate. It insures an absolutely uniform bearing and consequent freedom from initial bending stresses in the post.

The posts and anchorage have been made unusually large and heavy for two reasons: (1) A very stiff post is required to resist the bending stresses due to the lateral thrust of the combined vibration, centrifugal and tractive forces, and to give the necessary rigidity to the structure. (2) The volume and importance of the business passing under as well as over the structure demanded that every precaution should be taken to prevent interruption of traffic from accidents. The many tracks underneath, with the possibility of derailments, constitute an ever-present source of danger. Actual experience in a previous wreck under the Merchants' Elevated work has shown that a stiff post thoroughly anchored will stand severe punishment. While it may be bent or broken in part, the chances are that it will stand and hold up the structure till it can be properly supported or repaired.

At the crossing of the main tracks of the Missouri Pacific Ry. and Terminal Railroad Association, additional precaution has been taken to secure the structure from collapsing in case the posts of either bent 318 or 319 are entirely knocked out of plane. The longitudinal girders have the bottom chords spliced sufficiently to sustain the dead load for a span length equal to the combined length of both girders. The ends are faced and butt together, and the top chords are held laterally.

The foundations are built on good clay or rock, or piles driven to rock. They are made of Portland cement concrete, in proportions of 1 part cement, 3 parts sand and 6 parts stone, and have granite capstones. The concrete in each pier to a level at least 3 ft. above the top of washers, and where possible for the entire pier, was put in place continuously. The piers are proportioned of sufficient size and weight to resist the overturning movement exerted by the anchorage. The standard floor consists of 8×9-in. long-leaf yellow pine ties, spaced 14 ins. c. to c. On curves the ties are a constant depth of 9 ins. under the inner rail and beveled to give the elevation to the outer rail. The ties were ordered cut to four standard bevels at the mills, and the variation in bevel on the easement curves was made in the dapping over the girders. Tie plates are used on every tie.

A special floor of buckle-plate covered with asphalt is used for spans 304-7 to make the structure serve as a roof over the St. Louis & San Francisco freight house. The rails are carried on tie plates on 6½×17½-in. longitudinal wooden stringers, supported about every 3½ ft. on 3 × 15 × 17-in. blocks resting on the buckle plates. There are inner guard rails of 5×3½×7-16-in. Z-bars, which rest on the wooden stringers, but are braced laterally about every 4 ft. by bracket frames of angles and plates, rigidly attached to the buckle plates. The Z-bars can be removed when necessary to renew the woodwork. They are held in place by 3½×6-in. angle lugs, riveted to them and bolted to the brackets by ⅞-in. turned bolts. The bolt holes in the lugs are slotted vertically to allow adjustment. The wooden stringers are held against the brackets by ⅞-in. bolts to keep them in line.

The structure is proportioned for Cooper's "Class Extra Heavy A" loading with provision for the tractive and centrifugal force of maximum trains on both tracks, in addition to the wind force. The material is all medium steel, except the rivet and anchor rods, which are soft steel. All the rivet holes are reamed and edges planed.

The foundation work and the erection of structure were done by the Terminal Railroad Association. The shop work was done by the Union Bridge Co., of New York, in accordance with the design furnished by the Chief Engineer of the Terminal Railroad Association. The foundation work was begun in July, 1894, and erection of steel work in December. The structure was opened to traffic March 17, 1895. All work has been under the charge of the writer as Chief Engineer of the Terminal Railroad Association.

* Eng. News, Dec. 21, 1889.

## STREET RAILWAY STATISTICS, JULY, 1895.

We reprint herewith from "The Street Railway Journal" for the current month a table giving the mileage of street railways operated by the different classes of motive power in each state in the Union, the number of cars operated and the total capitaliza-

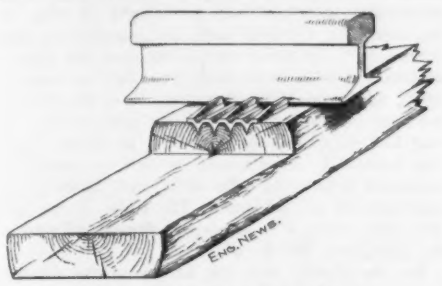
Street Railway Statistics for July, 1895.

| States. | No. of roads. | Miles of track. Horse. | Electric. | Cable. | Miscel. | Total. | No. of cars. Total. | Per mile track. | Stock & bonds issued. Total. | Per mile track. |
|---|---|---|---|---|---|---|---|---|---|---|
| Maine | 11 | 28 | 63 | .. | .. | 91 | 198 | 2.16 | $3,435,925 | $37,500 |
| New Hamp. | 5 | 27 | 27 | .. | .. | 54 | 121 | 2.28 | 835,000 | 15,700 |
| Vermont | 2 | .. | 14 | .. | .. | 14 | 31 | 2.15 | 480,000 | 33,300 |
| Mass. | 54 | 77 | 892 | .. | .. | 969 | 3,896 | 4.02 | 54,631,375 | 56,300 |
| Rhode Island. | 9 | 3 | 155 | .. | .. | 158 | 520 | 3.29 | 23,212,500 | 146,800 |
| Connecticut | 23 | 33 | 241 | .. | .. | 274 | 753 | 2.75 | 14,729,500 | 53,700 |
| New York. | 98 | 353 | 1,020 | 46 | 164 | 1,583 | 9,115 | 5.76 | 329,308,168 | 207,100 |
| New Jersey. | 36 | 53 | 418 | .. | 2 | 473 | 820 | 1.75 | 61,098,250 | 129,400 |
| Pennsylvania. | 124 | 48 | 1,304 | 62 | 8 | 1,422 | 4,021 | 2.82 | 158,601,410 | 111,500 |
| Delaware | 3 | .. | 26 | .. | .. | 26 | 64 | 2.49 | 958,000 | 37,200 |
| D. C. | 11 | 63 | 52 | 28 | .. | 143 | 927 | 6.49 | 11,835,500 | 82,900 |
| Maryland | 11 | 24 | 205 | 21 | 2 | 252 | 668 | 2.66 | 25,812,000 | 102,600 |
| Virginia | 16 | 16 | 134 | .. | 4 | 154 | 290 | 1.89 | 7,877,250 | 51,400 |
| W. Va. | 6 | 10 | 30 | .. | 9 | 49 | 90 | 1.88 | 2,022,000 | 42,100 |
| Michigan | 30 | 60 | 272 | .. | 9 | 341 | 1,006 | 2.95 | 14,670,200 | 43,100 |
| Ohio | 63 | 58 | 972 | 43 | 4 | 1,077 | 3,254 | 3.02 | 74,276,750 | 68,900 |
| Indiana | 29 | 25 | 297 | .. | 8 | 330 | 755 | 2.29 | 16,833,550 | 51,000 |
| Kentucky | 11 | 59 | 147 | .. | .. | 206 | 625 | 3.03 | 14,026,900 | 68,100 |
| Wisconsin | 18 | 20 | 249 | .. | 12 | 281 | 472 | 1.68 | 20,907,000 | 74,300 |
| Illinois | 49 | 267 | 529 | 86 | 69 | 951 | 5,815 | 6.12 | 122,131,025 | 128,500 |
| Minnesota | 14 | 11 | 516 | 13 | .. | 540 | 1,995 | 3.69 | 56,137,000 | 103,900 |
| Iowa | 24 | 18 | 210 | 7 | 8 | 243 | 461 | 1.90 | 13,022,100 | 53,600 |
| Missouri | 40 | 37 | 386 | 103 | 24 | 550 | 2,553 | 4.64 | 64,204,000 | 116,700 |
| N. Carolina. | 11 | 4 | 37 | .. | 4 | 45 | 81 | 1.82 | 1,766,700 | 39,600 |
| S. Carolina. | 6 | 36 | 10 | .. | .. | 46 | 103 | 2.25 | 758,000 | 16,600 |
| Georgia | 19 | 21 | 246 | .. | 14 | 281 | 402 | 1.42 | 10,016,500 | 35,600 |
| Florida | 7 | 24 | 11 | .. | .. | 35 | 124 | 3.57 | 367,100 | 10,500 |
| Alabama | 20 | 27 | 70 | .. | 126 | 223 | 311 | 1.40 | 8,459,800 | 38,100 |
| Mississippi | 6 | 21 | .. | .. | 2 | 23 | 60 | 2.67 | 231,500 | 10,300 |
| Tennessee | 23 | 16 | 178 | 6 | 67 | 267 | 473 | 1.77 | 11,116,600 | 41,600 |
| Louisiana | 12 | 36 | 159 | .. | .. | 195 | 226 | 1.16 | 22,124,350 | 113,400 |
| Arkansas | 7 | 29 | 32 | .. | .. | 61 | 150 | 2.46 | 1,894,075 | 31,100 |
| S. Dakota. | 6 | 17 | 11 | .. | 7 | 35 | 21 | .60 | 425,000 | 12,100 |
| Nebraska | 13 | 49 | 169 | .. | .. | 218 | 464 | 2.12 | 12,412,500 | 56,900 |
| Kansas | 12 | 36 | 83 | .. | 11 | 130 | 185 | 1.43 | 6,505,000 | 50,200 |
| Texas | 40 | 81 | 242 | .. | 24 | 347 | 531 | 1.53 | 12,180,601 | 35,100 |
| Colorado | 11 | 8 | 208 | 30 | 15 | 261 | 638 | 2.44 | 20,050,000 | 76,800 |
| Montana | 4 | .. | 52 | 2 | 2 | 56 | 69 | 1.25 | 2,950,000 | 53,500 |
| Idaho | 1 | .. | 3 | .. | .. | 3 | 2 | .67 | 53,300 | 17,800 |
| Utah | 4 | .. | 90 | .. | 6 | 96 | 120 | 1.25 | 3,200,000 | 33,400 |
| Washington | 23 | 7 | 187 | 18 | 4 | 216 | 244 | 1.13 | 15,276,000 | 70,800 |
| Oregon | 12 | 7 | 99 | 7 | 24 | 137 | 218 | 1.60 | 5,186,000 | 38,100 |
| California | 52 | 205 | 317 | 100 | 50 | 732 | 1,887 | 2.57 | 74,121,282 | 101,100 |
| United States. | 976 | 1,914 | 10,363 | 632 | 679 | 3,588 | 44,745 | 3.29 | 1,300,139,711 | 95,600 |
| Canada | 32 | 43 | 389 | .. | .. | 432 | 1,011 | 2.34 | 18,792,800 | 43,500 |

tion. Our contemporary states that great pains have been taken to make the figures complete, and that the statistics of mileage and cars are probably within 5% of the actual, in every state except Pennsylvania, where construction is just now progressing so rapidly that the figures may be as much as 10% in error. The capitalization given is the amount of stock and bonds actually outstanding, no account being made of securities authorized but not issued:

## THE WOLHAUPTER TIE-PLATE.

The increasing favor with which railway managers and engineers are regarding the use of metal tie-plates as a means of improving the safety and permanence of the track, and reducing the maintenance expenses, has been a spur to the inventors of such appliances. We illustrate herewith one of the latest of these tie-plates invented by Mr. Benjamin Wolhaupter, and put on the market by the Railroad Supply Co., Owing's Building, Chicago. The plate is rolled with a number of longitudinal ridges, arranged in such a way as to form sharp-edged flanges to bite into the wood of the tie (practically parallel with the grain of the wood) and a series of bearing surfaces for the rail. The channels or spaces between the bearing surfaces receive any sand from the engine or ballast which might otherwise work under the rail and cause grinding and wear of the rail base and tie-plate. The spaces between the lower flanges are approximately of arch form, so that the wood is compressed between the flanges. On the outer side of the plate are three lugs or shoulders which take the lateral pressure of the rail and relieve the outer spike from "necking" or wear by the edge of the rail base. A somewhat common fault of tie-plates under heavy traffic has been the cocking up of the ends. The very considerable depth of the plate should apparently be sufficient to prevent any trouble of this sort.




The Wolhaupter Tie-Plate.

## SEWAGE PURIFICATION IN AMERICA.

(Continued from Vol. XXXIII., p. 419.)

### Broad Irrigation and Intermittent Filtration at Meriden, Conn.

The city of Meriden, Conn., has made a good beginning in the construction of one of the largest and best designed systems of sewage purification by land disposal in this country. It has bought nearly 150 acres of land for this purpose, some of which has been receiving sewage since the fall of 1893, although the quantity treated in that year was small. The land seems to be admirably suited for a combination of broad irrigation and intermittent filtration. An attempt at sewage farming on a large scale at this disposal area would be watched with great interest. With so many markets, great and small, near at hand, such an attempt would promise well, provided proper proportions were maintained between the irrigation and filtration areas, and with the very important provisos that political crops should not be raised and that the farm should be run on business principles, under competent direction, with good sanitary results always placed first and financial returns last.

Meriden had a population of 21,652 within its corporate limits by the census of 1890, and of 15,540 ten years earlier. Within the township of Meriden, which includes a considerably larger area, there were 25,423 people in 1890, but thus far the sewerage system is for the use of the city only. The area of the city is 2,414 acres. Water-works were built by the city in 1869.

Meriden lies over 20 miles from the sea and there is no stream at hand suitable to receive its sewage in a crude state. Harbor Brook flows through the central and lower part of the city and empties into the Quinnipiac River, not far from the southern city limits. This brook gradually became polluted with sewage from short lines of sewers built before the adoption of a sewerage system until it became a nuisance. The Quinnipiac River could not be used as a sewer outlet, and the situation became serious.

Early in 1891 a special committee of five was appointed to investigate and report on sewers. This committee visited some sewage purification works and in September, 1891, submitted to the city council reports by Messrs. T. H. McKenzie, Simpson C. Heald and Carrol Ph. Bassett. Mr. McKenzie's report, based on preliminary surveys, recommended broad irrigation, supplemented by intermittent filtration, on a tract of land which was afterwards bought for the purpose. The center of the tract proposed was about 17,500 ft. from the central part of the city, and about two miles south of the city limits. The ground water here was reported by Mr. McKenzie as 16 ft. below the surface, but at what time of the year was not stated. It is interesting to note, in the light of the subsequent events mentioned below, that Mr. McKenzie said, in this connection: "It is not probable that underdraining will be necessary"; but so far as he gave details in his report they related almost wholly to irrigation. Mr. Heald concurred in Mr. McKenzie's report.

Mr. Bassett was called in after Mr. McKenzie's report was submitted to the special committee. Mr. Bassett suggested some changes in Mr. McKenzie's recommendations, but approved them in the main. These recommendations were also approved by the Connecticut State Board of Health.

The sewer committee reported to the city council in September, 1891, recommending that the separate system of sewerage, with sewage disposal on land, be adopted, and that a city meeting be called to take action on the matter. The city council adopted the recommendations and on Sept. 22, 1891, at a special city meeting, the recommendations were approved, maps and plans were ordered made, the mayor and chairman of the special sewer committee were authorized to buy 100 or more acres of land and $10,000 was appropriated for these purposes.

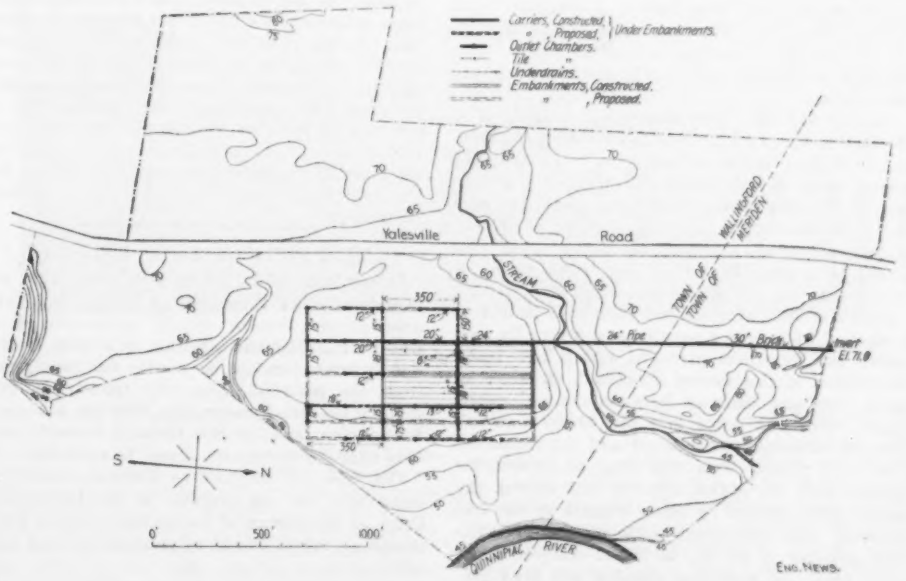



FIG. 120. SEWAGE DISPOSAL AREA AT MERIDEN, CONN.

An area of 145½ acres of land lying within the towns of Meriden and South Wallingford, but entirely outside the city limits and some distance from any dwellings, was bought for $7,148. On Oct. 8, 1891, a contract was made with Mr. Bassett for a topographical survey of the city and the disposal lands and for the necessary detailed maps and plans of the sewerage and sewage disposal system. On Jan. 28, 1892, Mr. Bassett submitted his report, with the required drawings and specifications. On March 31, 1892, Mr. Bassett was engaged as consulting engineer during construction; Mr. W. S. Clark, then city surveyor, was engaged as chief, and Mr. Edw. N. Pike, as assistant engineer. It was decided to do the disposal area work by day labor and the other work by contract.

The pipe system was designed for a population of 70,000, distributed over the city in different densities, with a per capita discharge of 100 gallons of sewage proper in 24 hours and a maximum hourly flow of 5 gallons per capita. This is equivalent to 13 cu. ft. per sec., but below the junction of the two collecting sewers the main outfall has a capacity of 17 cu. ft. per sec. when running full. This allows 4 cu. ft. per sec., or 2,600,000 gallons a day, for ground and surface water, the total daily capacity of the outfall being 11,016,000 gallons. Thus, on the assumption that only house sewage reached the sewers, their daily capacity would be equal to 157.4 gallons per capita for 70,000 people.

The main outlet is a 36-in. brick sewer, or its equivalent in capacity, with a length of some 8,000 ft. below the junction of the two trunk sewers. The outlet reaches the disposal area on an embankment, and is here a 30-in. circular brick carrier, which changes to a 24-in. vitrified pipe carrier.

The disposal area is shown by Fig. 120. Mr. Bassett proposed to utilize at the start some 32 acres for broad irrigation, which was to be prepared at very slight expense. He laid out, on his plans, 13 acres for intermittent filtration, in 15 beds, but proposed to construct only eleven of these at first. Only four filter beds were constructed, each 150 × 350 ft., giving an area of 4.93 acres. The construction of ten more beds, four of the above size and six of half that size, was begun in July, 1895.

Most of the above information has been taken from the Meriden Municipal Register, for 1891 and 1892, which gives the reports of the special sewer-committee, including the reports of the engineers named above. These sources of information have been supplemented by some remarks made by Mr. Clark before the Connecticut Society of Surveyors and Civil Engineers, printed in the proceedings of that society for 1892-3. The matter which follows has been prepared from notes taken on a visit to the disposal area made July 12 by a member of the editorial staff of this journal, through the courtesy of Mr. E. B. Moss, who has been city surveyor of Meriden since February of this year.

The disposal area, or at least that portion of it already and now being laid out in beds, consists of a 3-ft. upper layer of fine material, below which is a layer of sand and gravel of unknown depth, admirably suited for filtration. The fine material has about 8 ins. of rather poor brownish black sandy top soil, below which is red loamy sand, so finely

divided as to show scarcely any grit when rubbed between the fingers. The sand and gravel below appear to the eye to be coarser than that in most, if not in any, of the other disposal areas in this country. Of the sand the bulk would make very good but somewhat coarse material for the ordinary range of building operations.

Only the upper 12 ins., or less, including the top soil, was removed at the time of constructing the four filter beds. This left 2 ft. or more of very fine material over the sand and gravel below. Six underdrains of 6-in. tile were placed in each bed, as shown in Fig. 120. These were placed 2½ ft. below the surface at their upper end and 5 ft. at their lower ends. At the junction of each underdrain with the main drain tile inspecting chambers were placed, consisting of a masonry chamber with a vertical tile projecting to the surface and fitted with a plug. The main underdrains discharged into watercourses leading to the Quinnipiac River.

Sewage began to flow to the beds in August or September, 1893, says Mr. Pike, who had charge of their construction as assistant engineer and was connected with the sewerage system until April 1, 1894. Up to the latter date, Mr. Pike states, but a small amount of sewage reached the beds. Connections were added throughout the year. On Dec. 1, 1893, there were 55, and on Dec. 1, 1894, 607 connections. The actual number of permits for connections issued up to July 12, 1895, was 694.

It is generally reported that but little effluent appeared in the underdrains from the very start, but the information on this point is indefinite. Later on, it is stated, the flow from the underdrains grew less and less until practically none appeared. As the beds, even though badly clogged, still passed some sewage it would appear that it must have gone past the underdrains down into the gravel.

In July, 1894, the removal of a part of the fine material from the beds was begun. The southeast bed of the original four was lowered 12 ins. and the others 6 ins., except that half of the northeast bed was not completed until the spring of 1895. About $800 was spent this way.

Notwithstanding this work the beds did not filter fast enough to prevent the accumulations of sewage; but it was poured on them nevertheless all winter. By spring they had become so clogged that it was necessary to put nearly all the sewage on the other part of the area, which apparently has never had much preparation. The beds had certainly been much overworked. They were not cleaned through the winter, nor until very late in the spring. One of them would take sewage only five hours without overflowing.

In May the beds were thoroughly cleaned. The sludge was raked off after it had dried by exposure. It rolled over and over under the rake and was placed in piles and carted off. Over the greater part of the area it was about ⅛ in. thick, but near the outlet it was 6 ins. deep. Most of it was plowed under on adjoining land, but some was placed in a pile. The latter was found to be inoffensive on the day of the visit mentioned above.

After the beds were scraped they were plowed to a depth of 14 ins. by a subsoil plow drawn by four horses, and were then harrowed with a light team. In addition to this twelve trenches 3 ft. wide, located over and halfway between the six underdrains, were dug down into the coarse material. The fine material was removed and the trench refilled with gravel. This was done to connect the surface with the gravel beneath and convey the sewage to it without its being stopped by the fine material. The aggregate width of these gravel-filled trenches is 36 ft., or about one-fourth the whole area. No screening chamber has been provided for removing paper and other fiberous matter from the sewage. The Superintendent, Mr. Geo. Williams, has placed what might be termed a fence screen a short distance from each outlet on one bed. This screen is of galvanized iron wire netting, 1 in. mesh, 2 ft. high. It will be changed for ¾-in. mesh and put on the other beds. A single screening chamber could doubtless be operated with less labor than that involved in cleaning the many screens now proposed, especially when the new beds are put in use. The above work, including the sludge scraping, cost about $1,400. Allowing $50 a bed, or $200 in all, for the scraping, the total cost of remodeling these four beds has been about $2,000.

On the day of the above mentioned visit sewage had been flowing on one of the beds for about five hours, but none had yet appeared at the underdrains, although the sewage was disappearing so rapidly that it covered only a part of the bed. Whether the underdrains have in some manner been entirely clogged, or whether the sewage passes directly down into the coarse, deep layer of gravel cannot be stated.

Acting on the supposition that the gravel will take care of the sewage, no underdrains are being put in for the ten new beds. These beds are shown by Fig. 120. Four of them are 150 and six are 75 × 350 ft., giving an area of 8.62 acres, which will make a total of about 13½ acres of filter beds. For the new beds 2 ft. of soil will be removed and before they are put in use their surface will be plowed to a depth of 14 ins., which will catch 2 ins. into the gravel. The estimated cost of the new beds is $10,000. The original work on the disposal area cost about $24,000.

On May 23, 1895, at 9 a. m., sewage was flowing to the disposal area, Mr. Moss states, at the rate of 68,400 gallons an hour. Further than this no idea of the amount of sewage treated can be given, except that there are now about 694 sewer connections, including hotels, stores and other large buildings. Mr. Moss thinks that half the population, or 15,000 people, are now tributary to the sewerage system, but this would give an average of more than 20 people to each connection.

The extent to which broad irrigation has been practiced cannot be stated. No attempt to raise crops on the irrigated area has yet been made, but this is under consideration for the future. The land is admirably situated, and much, if not all of it, seems to the casual observer well suited to this purpose; in fact, it was selected for these reasons.

Past difficulties at Meriden seem to have been caused by heavy overdosing and by the fine material of the beds. Now that some of this material has been removed, the gravel-filled trenches put in and a start made to add more beds, there seems to be no reason why intermittent filtration here should not be as successful as elsewhere. If a liberal area of land were properly laid out for and devoted to broad irrigation the work of the beds might be greatly lessened in summer and perhaps crops could be raised on the irrigated area which would pay for quite a large proportion of the expense of disposal. The experiment would be well worth trying, whatever the result, but should be carried out under careful supervision, and, if possible, by some one of experience. In conclusion, the results thus far obtained at Meriden confirm the excellence of the system of purification there in use, but they teach the evils of overdosing, the limitations of fine filtering material and the necessity for continuous skilled supervision.

## THE TEHUANTEPEC RAILWAY.

In our issue of July 4 an article appeared under the above head furnished us by the firm whose name appears therein. Mr. E. L. Corthell, M. Am. Soc. C. E., calls our attention to several errors in this statement; and as the matter was mainly taken from the pamphlet upon this railway enterprise written by Mr. Romero, the Mexican Minister at Washington, and by Mr. Corthell himself, he desires that the statements should be corrected.

The table of comparative distances, when compared with the one compiled at the Hydrographic Office of the Bureau of Navigation, contains several missprints, which should be corrected to read as follows:

| | Via Tehuantepec R. R. | Via Panama R. R. |
|---|---|---|
| New York to Hong Kong | 11,597 | 12,645 |
| " " to Auckland | 9,345 | 9,813 |
| Liverpool to Yokohama | 13,223 | 14,175 |

A more full and correct description of the terminals here follows: The Coatzacoalcos River, at the Gulf terminus, carries to the sea for several months of the year a large volume of fresh water; and as the rainfall is quite regular upon its watershed of 6,500 sq. miles, this may be depended upon to give a sufficient velocity for excavating and maintaining a deep channel through the bar at the mouth of the river. Some miles inside of its mouth this river is 1,000 ft. wide, with an average maximum depth on cross-sections of 70 ft. and a cross-sectional area of 40,000 sq. ft. The South Pass of the Mississippi River has a cross-section of 24,000 sq. ft. There is practically inside of the headlands a harbor at least 10 miles long; and immediately at the mouth this harbor area has a 30-ft. channel 1,000 ft. wide and a 40-ft. channel 850 ft. wide. Of the two headlands at the mouth one is made of sand dunes and the other is solid land, not "rock" as stated in our former article.

For the improvement of the mouth of this river the plans propose parallel jetties, 4,500 ft. long and 800 ft. apart (not 300 ft. as stated) extending to about 24 ft. depth in the gulf. The material in the permanent structure will be entirely of rock. At the time Mr. Corthell made his examination there were 14½ ft. of water on the bar, and this depth is maintained with little variation. Surveys made in 1871, 1881 and 1892 show that there has been no advance of this bar for 20 years past; in fact, the bar has decreased about 400 ft. in width. Inside the harbor it is proposed to build a wharf, of creosoted timber and piles, or of steel, 2,000 ft. long and parallel to the shore. The slope of the bank into deep water is so steep that this wharf need not be more than 100 ft. wide.

On the Pacific side the harbor works will consist mainly of a breakwater of broken stone coped with concrete blocks. The shallow bay at this point has an arc of about three miles and the promontory on the west is about 200 ft. high and consists of a hard, durable rock, made up of quartzite, syenite and porphyry. The sand here is a coarse, hard grit, excellent for concrete-making purposes. The action of the waves and currents is almost normal, or at right angles to the beach, no matter from what direction the wind may blow, and the current is always eastward. There is a constant surf upon the beach of sufficient magnitude to swamp any small boat, except during the prevalence of one of the strong northers of winter, when but little surf exists. It will be necessary then to form a protected and quiet harbor.

The estimated cost of the jetties and auxiliary work at the Gulf terminus is about $2,250,000; the proposed terminal wharf and its equipment will cost $360,000; the Salina Cruz breakwater, on the Pacific side, will cost $2,700,000, and the terminal piers and dredging $385,000. The total estimated cost of the harbors and terminals will thus be $5,695,000 in gold.

## REVERSING LOCOMOTIVES IN EMERGENCY STOPS.

It is still a common opinion among locomotive engineers that the best way to quickly stop a train in an emergency is to reverse the engine, and this method is still very generally practised, having become a habit with enginemen in the days before driving-wheel brakes were used. Under modern conditions, with fast engines equipped with driving-wheel brakes, the quickest and most efficient emergency stop is made with these brakes alone and steam shut off, for the reason that reversing with the brakes on is certain to cause the wheels to slide (thus reducing the retarding force due to friction between the rail and a braked wheel), and is very likely to cause a breakage of some part of the machinery. The reasons for this were discussed at some length in our issue of Oct. 5, 1893, and we find in "Locomotive Engineering" for July an account of a series of tests made to determine this point, the results of which were reported at the convention of the Association of Railroad Air-Brake Men. These tests were made on the Nashville, Chattanooga & St. Louis Ry., under the supervision of Mr. J. W. Thomas, Jr., Assistant General Manager, in order to ascertain the relative distance in which stops can be made, (1) with the air-brakes alone, (2) with the engine reversed, and (3) with air-brakes applied and engine reversed at the same time.

The tests were made with an engine and tender, the driving wheels being fitted with the push-down cam brake operated in connection with the tender brake. The train pipe was opened by a trip on the

Tests to Determine Best Method of Stopping Passenger Trains in Emergencies.

| No. | Stop made by: | Train. | Speed. | Sand. | Total No. stops. | Max. stop, ft. | Min. stop, ft. | Ave. stop, ft. | Time, secs. | Wh'ls slid. | Flat spots. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Driver and tender brakes | Eng. & tend. | 30 | No | 9 | 280 | 240 | 254 | 11 | No | No. |
| 2 | " brake alone | " " " | 30 | " | 2 | 438 | 387 | 412 | 18 | " | " |
| 3 | Tender " " | " " " | 30 | " | 7 | 604 | 458 | 538 | 23 | " | " |
| 4 | No brakes, engine reversed | " " " | 30 | " | 3 | 464 | 428 | 450 | 20 | Lock.[4] | " |
| 5 | Driver & tend. brakes & eng. reversed. | " " " | 30 | " | 4 | 290 | 245 | 276 | 12 | Yes | 2½-in. |
| 6 | No brakes and engine "plugged" | " " " | 30 | " | 2 | 540 | 505 | 522 | 25 | Lock.[4] | No. |
| 7 | Driver and tender brakes | " " " | 30 | Abund. | 1 | 290 | 290 | 290 | 11 | No | " |
| 8 | No brakes and engine reversed | " " " | 30 | " | 1 | 280 | 280 | 284 | 12 | " | " |
| 9 | " " " "plugged" | " " " | 30 | " | 1 | 285 | 285 | 285 | 11 | " | " |
| 10 | Driver & tend. brakes & eng. reversed. | " " " | 30 | No fresh[5] | 4 | 177 | 140 | 158 | 9 | " | " |
| 11 | Driv. & tend. bks., with eng. "plug'd". | " " " | 30 | " " | 1 | 177 | 177 | 177 | 9 | " | " |
| 12 | Driver and tender brakes | " " " | 20 | No | 1 | 111 | 111 | 111 | 8 | " | " |
| 13 | No brakes and engine reversed | " " " | 20 | " | 1 | 161 | 161 | 161 | 9 | " | " |
| 14 | Driver and tender brakes | " " " | 20 | Yes | 1 | 90 | 90 | 90 | 6 | " | " |
| 15 | " " " | " " " | 40 | No | 1 | 532 | 532 | 532 | 25 | " | " |
| 16 | No brakes, engine reversed | " " " | 40 | " | 2 | 861 | 820 | 840 | 32 | Lock.[4] | " |
| 17 | Driver and tender brakes | " " " | 40 | Yes | 1 | 475 | 475 | 475 | 20 | No | " |
| 18 | All brakes cut in | Eng., tend. &[1] | 30 | No | 8 | 271 | 260 | 258 | 11 | " | " |
| 19 | " " " " | " " " | 30 | Yes | 1 | 250 | 250 | 250 | 11 | " | " |
| 20 | " " " and eng. reversed | " " " | 30 | " | 7 | 335 | 199 | 265 | 11 | Yes | 3-in. |
| 21 | " " " " | " " " | 40 | No | 4 | 500 | 400 | 474 | 19 | No | No. |
| 22 | " " " " | " " " | 40 | Abund. | 1 | 475 | 475 | 475 | 19 | " | " |
| 23 | " " " " and eng. reversed | " " " | 40 | Yes | 1 | 542 | 542 | 542 | 23 | Yes | 4-in. |
| 24 | " " " " | " " 5[2] | 30 | No | 1 | 327 | 327 | 327 | 14 | No | No. |
| 25 | " " " " | " " " | 35 | " | 1 | 465 | 465 | 465 | 19 | " | " |
| 26 | " " " " | " " " | 40 | " | 2 | 575 | 575 | 575 | 25 | " | " |
| 27 | " " " " | " " &[3] | 30 | " | 1 | 367 | 367 | 367 | 14 | " | " |
| 28 | " " " " | " " " | 40 | " | 1 | 702 | 702 | 702 | 26 | " | " |
| 29 | *" " " " and eng. reversed | " " " | 30 | Yes | 9 | 375 | 218 | 350 | 13 | Yes | 2¾-in. |
| 30 | †" " " " " " " | " " " | 30 | " | 1 | 325 | 325 | 325 | 13 | No | No. |
| 31 | *" " " " " " " | " " " | 30 | " | 1 | 375 | 375 | 375 | 14 | Yes | 3-in. |
| 32 | Pullman sleeper (kicked) | | 30 | No | 1 | 416 | 416 | 416 | 18 | No | No. |
| 33 | N., C. & St. L. coach (kicked) | | 30 | " | 1 | 202 | 202 | 202 | 10 | " | " |

† Expected emergency.
[1] Engine, tender and five N., C. & St. L. coaches.
[2] Engine, tender, five N., C. & St. L. coaches and four Pullmans.
* Unexpected emergencies.
[3] Engine, tender and four Pullman sleepers.
[4] Locked and revolved backwards.
[5] No fresh sand.

track, and another trip opened the signal pipe, giving the engineman a signal to reverse the engine simultaneously with the application of the brakes. The track was level and in good condition, and the tests were made under favorable circumstances. The engine was equipped with a Boyer speed-recorder, which was tested every day. The braking power on the wheels was as follows:

On driving wheels..... 70%
On tender wheels .....100% of light weight
On wheels of N., C. & St. L. Ry. cars.....10%
On wheels of Pullman sleeping cars.....40 to 101%

The order of operations was as follows: 1, brake applied; 2, engine reversed; 3, sand applied. Nearly one hundred stops were made and the averages of the results are given in the accompanying table. The deductions to be drawn from the tests are summarized as follows:

1. The shortest reliable stops will be made by a retarding power which is most quickly developed and maintained to the highest possible limit during the entire stop, consistent with safety from skidding of wheels, such as the air-brakes give.

2. The retarding power given by the back pressure in the steam cylinders when the engine is reversed fluctuates and is too inconstant to be relied upon. As soon as the back pressure developed is greater than the adhesion between the wheel and the rail, the driving wheels will revolve backwards and lose nearly all retarding force. Trials were made throwing the reverse lever ahead a sufficient length of time to release the wheels and get them running forward again: but so much time and distance were lost in this effort that the stop exceeded in length that made by leaving the lever in the back motion after it had been placed there. The length of stop was the same, whether the cylinder cocks were opened or closed. When the engine was reversed without brakes, the wheels did not lock rigidly.

3. The length of stop made with air-brakes applied and engine reversed, while being longer and extremely injurious to the tire from skidding and making flat spots, is not as long as was expected, but is satisfactorily accounted for by the fact that as the flat spot grew during the stop, and, with the heat developed, gave a larger and better surface to the rail for adhesion. The stop was longer than those made with the brakes alone, and was very costly. The results of these tests should determine the inadvisability of using the reverse lever in conjunction with air-brakes.

4. Sand is a good thing if judiciously used, but if used after wheels are skidding will produce flat spots and will not unlock wheels after they commence sliding. A superabundance of sand is not quite so effective as a moderate amount. The best results were had from a rail upon which sand remained from previous stop. Upon a rail thoroughly "saturated," but not burdened with sand, it was impossible to slide the wheels under the conditions which prevailed. On straight track, if sand reached the rail before full retarding power was developed by the air-brake and the back pressure in the steam cylinders with engine reversed, wheels would not lock nor slide; but on curves where engine rolled about the adhesion between the wheel and rail, even when increased by a free flow of sand, would be broken, and the drivers would lock and slide with disastrous results. Several of the "unexpected emergencies," as recorded in Nos. 29 and 31, were made on curves, but the majority were made on straight track. If sand valves were opened before brakes were applied and engine reversed, the wheels would not lock in "expected emergencies," but the delay in applying retarding power would slightly lengthen the stop over that had by the use of the air-brakes alone.

5. In making the "unexpected emergency" stops, the drivers would invariably lock when engine was reversed, and flat spots were had. In one instance the engineer, who was unusually expert and active, got tangled up with the reverse lever, and did not succeed in reversing the engine with his first effort. The train ran considerably farther than the length of stop given in No. 29. The time consumed by the engineer in applying brakes, reversing engine and opening sand valves was 1½ seconds, which is very much quicker than the feat can be accomplished ordinarily. When, also, considering the fact that a certain length of time is consumed by the engineer recovering from the bewilderment of unexpected emergencies, it would seem impossible for him to get sand on the rail before the wheels would lock, if he were to reverse his engine after applying the brake. The "expected emergency" given in No. 30 was a good stop, but engineers seldom meet expected emergencies.

6. The Pullman cars were not braking as they should, as the piston travel on all cars varied from 10 to 12 ins. After the slack was taken up, better stops were had. The percentage of braking power on these cars had an abnormally wide range. The condition of the brake apparatus upon the N., C. & St. L. Ry. coaches, which were taken from service without any preparation for the test, speaks eloquently for the system of maintenance of brakes on this railway. Tests Nos. 32 and 33 were made by backing the car with the engine until the desired speed was developed; then the angle cock was closed, engine detached and hose uncoupled. The angle cock was opened at a certain point, from which the stop was taken. A comparison of the stops made by the sleeper and the coach will, perhaps, cause a surprise to some readers, and perhaps open up a new line of investigation, which, if followed up, will reduce the number of slid flat wheels on coaches.

## CHICAGO MAIN DRAINAGE CHANNEL.

### IX.

### Steam Shovels.

The successful bidders for the different sections of the Chicago Drainage Channel were for the most part men who had received their contractors' training in building railways. It was natural, therefore, that they should bring to the work the machine which their railway experience had shown to be absolutely indispensable where large amounts of excavation had to be done, and we find the American steam shovel used in large numbers and in a great variety of designs all along the channel. Indeed the steam shovel has been the prime factor in the extraordinarily economical handling of large quantities of earth, which has characterized the canal work. While the methods of conveying the spoil from the canal have varied widely on different sections, the system of excavation proper, in earth of course, has been the same on all—viz., by steam shovels. It seems proper, therefore, notwithstanding the familiarity of this device to American engineers, to describe with some carefulness the more prominent of the various types of shovels used, although some things that we say may repeat what is already familiar to many of our readers.*

Practically all of the steam shovels used on the canal have been furnished by six manufacturers—viz., the Bucyrus Steam Shovel & Dredge Co., South Milwaukee, Wis.; the Marion Steam Shovel Co., Marion, O.; the Osgood Dredge Co., Albany N. Y.; the Vulcan Iron Works Co., Toledo, O.; the Vulcan Iron Works, Chicago, Ill., and the Toledo Foundry & Machine Co., Toledo, O. Each of these manufacturers is represented by two or more shovels, and generally by two or three weights and patterns of shovels. These machines, of course, differ from each other in special features and details, but they are all alike in their general construction and in the principle of operation. Each consists of (1) a strong framework or car, mounted on wheels, which is the base to which all working parts are attached; (2) a swinging crane carrying the dipper and dipper handle, and which is attached to a mast or post at the front end of the car; and (3) a boiler, engine and other mechanism which is placed on the floor of the car, and operate the crane and dipper by means of chains, wire ropes or other devices. All of these features are clearly indicated by the accompanying illustrations.

FIG. 34. VIEW OF BARNHART STYLE AA SHOVEL AT WORK ON SECTION M.
Marion Steam Shovel Co., Marion, O., Builders.

The differences between different makes of steam shovels are chiefly in the methods of constructing these three essential parts. For example the crane may be a trussed crane attached to a vertical mast,

* A valuable series of articles on Steam Shovels and Steam Shovel Work was contributed to Engineering ing News in 1893 by Mr. E. A. Hermann, M. Am. Soc. C. E., and afterwards published in book form with additional matter. These articles describe in detail all of the shovels mentioned here and may be consulted for special details.

as in the Victor shovel, or it may be a boom pivoted at the bottom and guyed to the car frame at the top as in the Barnhart shovel. The engines may be vertical or horizontal and may apply their power through friction clutches or by direct gearing. These differences, as far as they pertain to the types of shovels at work on the Drainage Channel, will be described briefly in the following paragraphs. As regards the records of work done by the different shovels, such figures as are available are given in the articles describing the several sections of the channel, where the conditions of the work and the character of the excavation, both prime factors in any comparison of steam shovel work, are fully described.

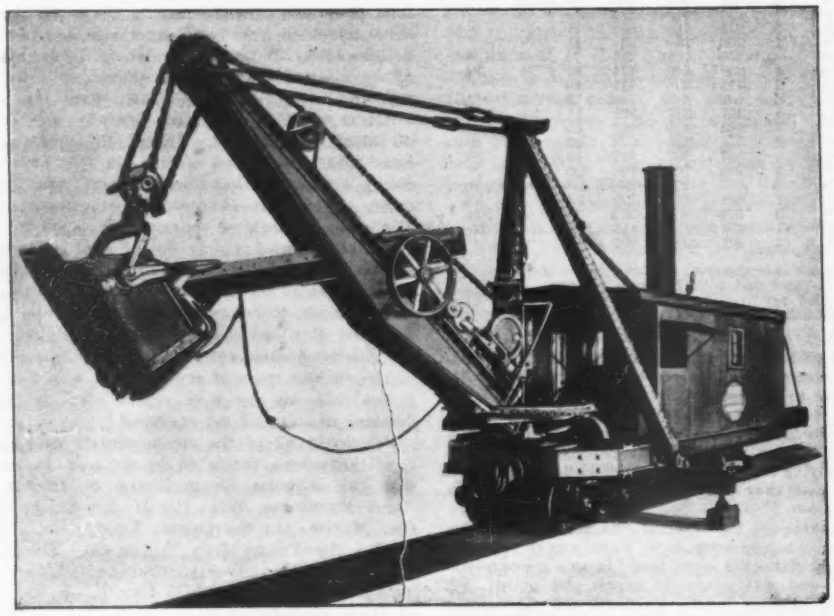


FIG. 35. VIEW OF BUCYRUS SPECIAL CONTRACTORS' SHOVEL, PATTERN O.
Bucyrus Steam Shovel & Dredge Co., South Milwaukee, Wis., Builders.

Barnhart Shovel.—This shovel is manufactured by the Marion Steam Shovel Co., of Marion, O., and is illustrated at work on Section M in Fig. 34. The shovel illustrated is one of the company's type AA, as are most of the shovels of this company's make in use on the Drainage Channel.

The car is 10 × 26 ft., built of steel channels and I-beams as follows: The floor rests on six 9-in. 22-lb. channels and two 9-in. 30-lb. I-beams, all of which are 30 ft. long. At the front end these channels and beams are fastened together with a ¾-in. steel plate 17 ins. wide and at the rear end a similar plate connection 1-in. thick and 9 ins. wide is fixed. The bolster under the car and the cross-beams are of oak with 7-in. channels bolted on each side. To convey the strain of digging to the floor, the frame of the car is composed of four bents, each of which is made up of 7-in. 18-lb. channels, except the cap and sill of the forward bent which are 8-in., 22-lb. channels. At the top corners these bents are connected by 7-in., 27-lb. I-beams running lengthwise of the car. The bents are thoroughly braced to each other and to the floor with 1½-in. and 1¾-in. steel rods provided with turnbuckles. It should also be stated that the members of these bents consist of two channels placed flange to flange and bolted together through cast iron fillers, and that an A-frame of 15-in. 50-lb. channels, to which the crane suspension rod is attached, runs back into the car and is firmly attached to the framework.

From this anchorage the crane suspension rod, 2½ ins. in diameter, runs to the front tip of the boom, to which it is connected by heavy springs so as to relieve the machinery from sudden shocks in digging. The boom is made of oak timbers trussed with steel rods, and the dipper handle is a 5½ × 14-in. oak timber. The foot of the boom rests in a socket in the casting that forms the turntable hub. The turntable is 8 ft. in diameter, with its rim and arms made of steel plates and iron channels, and is mounted on a heavy cast iron base forming a journal 16½ ins. in diameter and 16½ ins. long.

Two 10 × 12-in. vertical engines operate the hoisting and swinging drums by means of cone frictions actuated by two friction clutches. The hoisting drum is 14 ins. in diameter and the swinging drums are 10 ins. in diameter and all these are mounted on the same shaft. From the drums the power is conveyed to the dipper and turntable by means of chains. A friction clutch geared to the hoisting drum enables the dipper to be fed independently of the hoisting chain.

The jack arms are of new design. The main brace is made of two 7-in. channel irons, each weighing 18 lbs. to the foot, fastened in position by wrought iron braces. The jack is so constructed that it can be swung alongside of the car when passing an obstruction, and is also arranged so that the jack screw can have its bearings at a distance of 9 ft. 8 ins. from the center of the car, or can be made to have its bearing very close to the side of the car. This is an important item in making a through cut, and other work where it is necessary to take cars past the machine. The jacks are so placed that the boom can be swung considerably past a right angle, which is also very important in most work. The jack screws are 3⅞ ins. in diameter.

Altogether about 20 Barnhart shovels have been used on the canal work, most of which were of the AA pattern. Figures relative to the work of the AA pattern shovel have been given in the articles on Sections K and I, M, L and others.

Bucyrus Shovel.—Four different patterns of shovels manufactured by the Bucyrus Steam Shovel & Dredge Co., South Milwaukee, Wis., are being used on different sections of the channel. These are, the No. 1, Crane; No. 1, Boom; No. 0, Boom, and No. 0, Special Contractors' Patterns. The last-named pattern was designed specially for the hard, indurated clay and cemented gravel excavation on the drainage channel, but the three others are the regular patterns which have been on the market for some time for general railway work.

The following table gives the general features of the No. 1 Crane and No. 1 Boom patterns in sufficient detail to give one a fair understanding of their construction:

| | Pattern. | |
|---|---|---|
| | No. 1, Crane. | No. 1, Boom. |
| Car | 10 × 30 ft. | 10 × 30 ft. |
| Trucks | M.C.B., 60,000 lbs. | M.C.B., 60,000 lbs. |
| Mast | 3½-in., cast iron | Steel, A-frame. |
| Boom | 19 ft., 19 ft. rad. | 23 ft., wr'ht iron. |
| Dipper | 1⅝ cu. yds. | 1¾ cu. yds. |
| Dipper-handle | Oak, 14 ft. | Oak, 14 ft. |
| Thrust motion | Friction clutch | Friction clutch. |
| Chains— | | |
| Hoisting | 1 in. | 1 in. |
| Swinging | ⅞ in. | ⅞ in. |
| Engine | 2-cyl., 8 × 12 ins. | 2-cyl., 8 × 12 ins. |
| Boiler | Vert., 4 × 8½ ft. | Vert., 4 × 8½ ft. |
| Capacity tank | 7 hours | 8 hours. |
| Jack arms— | | |
| Material | Wrought iron | Wrought iron. |
| Size screw | Steel, 4½ ins. | Steel, 4½ ins. |
| Weight | 35 tons | 45 tons. |

The No. 0 Boom pattern is similar in its general features to the No. 1 Boom pattern, but is heavier, weighing 52 tons instead of 45 tons, and has more steel in its construction. It has a double cylinder, 10 × 12-in. engine, and the dipper is 2¼ cu. yds. capacity.

From a careful study of the operation of the shovels just described in excavating the cemented gravel, the builders designed the No. 0, Special Contractors' Shovel shown in Fig. 35. A general detail drawing of this shovel was published in Enginering News, March 21, 1895. The principal features which distinguish it from the No. 0 Boom pattern, beyond its much greater weight, are (1) the high A-frame built up of steel channels and plates; (2) the powerful independent thrusting engines on the boom instead of the friction clutch thrusting arrangement, and (3) the jack beam, which also serves as a base for the A-frame. These details are all quite clearly shown by the illustration.

The A-frame is 14½ ft. high, and is made very strong to carry the strain of the heavy boom and dipper handle, which are fully as large as are used in heavy lake dredges. It will be noticed also that the dipper has a sharp outward pitch, so that the thrust of the engines will be most effective, and also that it is fastened to the handle by a single casting. The reason for this solid construction will be readily understood when it is stated that the engines on the boom have a thrusting power of 30 tons. Another feature of this part of the design is that the lines of stress in the dipper handle and dipper bail intersect in a point close to and in line with the dipper teeth. The engines are 10 × 14 ins.

FIG. 36. VIEW OF VICTOR SHOVEL, CLASS SPECIAL, FOR SECTIONS A AND B.
Toledo Foundry & Machine Co., Toledo, O., Builders.

Altogether 26 Bucyrus shovels have been worked on the canal. Figures relative to the work of the No. 1 Boom pattern will be given in the description of Sections 2 and 4, where also the work of the No. 0 Special Contractors' pattern will be described.

Similar records of the work of the No. 0 Boom pattern have been given in the descriptions of Sections M and L, and Section D.

Victor Shovel.—This shovel is manufactured by the Toledo Foundry & Machine Co., of Toledo, O., two patterns—viz., Class No. 1 and Class Special—being used on the drainage channel. Fig. 36 is a view of one of the Class Special shovels which is now at work on Sections A and B. Some half-dozen shovels of the two classes have been worked on the canal.

The Class No. 1 shovel weighs about 46 tons, and is 56 ft. long and 9½ ft. wide over all. The crane is built of steel, and is hung from a hollow cast iron mast, with the swinging drum at the top. Ordinarily the swinging is done by two steam cylinders placed on the top of the car, but in one of the shovels used on the canal a chain operated by a pair of 6 × 6-in. reversible engines is used. The thrusting motion is obtained from a pair of independent engines mounted on the crane, and the hoisting motion is imparted by a chain, which extends from the hoisting engine drums to the foot of the mast, and hence up through the hollow mast to the dipper. The jack arms are steel castings fastened to the car floor and braced to the top of the mast. Steel jack screws work in the steel castings.

The Class Special shovel, which is illustrated, is similar to the Class No. 1 in its construction, but is larger, weighing 54 tons, and being 10 ft. wide and 65 ft. long over all. In both patterns the car is built of steel beams and channels, and is mounted on standard M. C. B. Fox pressed steel trucks. All gearing is of steel. The water tank is placed under the car, and has a capacity of about one-half day's supply of water.

Osgood Shovel.—Only three "steam excavators" of the type manufactured by the Osgood Dredge Co., of Albany, N. Y., are being used on the drainage channel. All of these are in operation on Sections 2 and 4, and all weigh 70 tons each. With the exception of the great 125-ton land dredge, built by the Marion Steam Shovel Co. for Section E, which hardly comes into the category of shovels for general work, these are the heaviest steam shovels on the canal.

A description of one of these shovels will answer for all, except in minor details. The car is 33 ft. × 9 ft. 8 ins., and is built of white oak and mounted on M. C. B. 60-000-lb. trucks. The boom, which is guyed from a high A-frame resting on an 18 × 18-in. oak jack beam, is 30 ft. long, and has a radius of delivery of 34 ft. The main engine is a two-cylinder, reversing, 10 × 12-in. engine, and the crowding engine, which is mounted on the turntable, is 6¼ × 8 ins. Unlike most shovels, the swinging and hoisting in this machine is done by the same chain; the machine is similar to a clamshell dredge in this respect. The thrust is given to the dipper by a chain, one end of which is attached to the rear end of the dipper arm, the chain then passing along its underside around a sprocket wheel, and thence to a fastening at the front end of the dipper arm. The sprocket wheel is revolved by means of a chain from the thrusting engine. The boiler is of the locomotive type, 54 ins. in diameter and 7 ft. long.

These three Osgood shovels have been worked in the cemented gravel of Sections 2 and 4, and have done excellent work. Somewhat detailed figures of their output will be given in the article on those sections.

Warrington Shovel.—This is an entirely new design of steam shovel, the two on Section A of the canal being the first ever built. As this machine was illustrated and quite fully described in our issue of July 4, it will be only briefly mentioned here. The car and framework is steel throughout, and is mounted on Fox pressed steel trucks. The crane is rigid and the swinging circle is overhead. A double-cylinder thrusting engine controls the thrusting motion of the dipper, and the hoisting, jacking, swinging and propelling are done by the main engine. The shovel is manufactured by the Vulcan Iron Works, of Chicago, Ill.

Giant and Little Giant Shovels.—These shovels are manufactured by the Vulcan Iron Works Co., of Toledo, O., and the two are very similar in their general design and construction, except that the Little Giant is mounted on broad-tired traction wheels to travel on ordinary roadways, and is much lighter. The framework and car are of steel, as is also the crane, which is hung from a cast iron mast with an overhead swinging circle. The thrusting motion is obtained by an independent engine mounted on the crane, and the swinging motion and hoisting motion are each obtained by an independent engine. The boiler is of the vertical type.

Both the Giant and Little Giant shovels have been worked on the channel, and figures of their output will be given in the articles describing Sections 6, 9 and 14.

The foregoing will give a pretty clear idea of the various types of steam shovels which have done the earth excavation on the drainage channel. Owing to the constant changes in the equipment, it is impossible to say just how many shovels have been worked from first to last, but a rough estimate places it between 60 and 70. The question naturally arises: How have these shovels shown up in the canal work? This is a rather difficult question to answer fairly. No one weight or style of shovel has shown itself superior in all cases of work; but for the hardest indurated clay and cemented gravel excavation the heaviest types described have proved too light, while the lighter types could not be worked at all. A somewhat careful inquiry has failed to show that failure occurred in any particular part of the shovel more than another, but rather that the structure throughout was too weak for the heavy work it was called upon to do. This statement, it will be understood, refers to the hardest digging.

For the information from which this article has been prepared we are indebted to the different steam shovel makers and the contractors and engineers of the Sanitary District.

## THE WEAR OF BRICK PAVING AT JOHNSTOWN, PA.

The city council of Johnstown, Pa., recently directed Mr. E. L. Goltstein, the City Engineer, to examine and report upon all streets paved with brick, and he has submitted the following report showing the cost and wear of such pavements:

I find the wear of the bricks surprisingly small. The bricks laid within the last two years still show their original surfaces, and beyond more or less spalling of the edges, the wear is practically nothing. Comparatively, the least amount of spalling occurs on Clinton St., and the greatest on Bedford St. Of the streets paved in 1891, Iron, Walnut and Main Sts. show a wear of less than ⅛ in. per yard, and, from present indications, should last 20 years longer before requiring repaving. The ruts, which are now wearing, can be readily filled with cement concrete that will last for years and is easily renewed when worn out at a comparatively trifling cost. The greatest damage done to the streets is not caused by the legitimate traffic, but by the indiscriminate filling in of excavations. As long as you permit the earth from such excavations to be used in refilling, so long will this destruction of your streets continue—since no amount of ramming or flushing with water will restore the soil to its original compactness. Gravel and sand are the only available materials for a cheap filling which will neither shrink nor settle.

From this cause the whole brick pavement on Washington St. is damaged as much as ten years' traffic would effect. Main St., from Clinton to Walnut, has also suffered much from this cause, and there is not one of your brick streets which does not show more or less bad effects from this source. If proper care and attention are given to the streets paved within the last two years, they should last for 30 years, and there is certainly no paving material in use which can compare for durability, smoothness, sanitary qualities, and cost combined with well-made paving brick, laid on a gravel foundation. For heavy loads, the width of the wheel tires should be proportioned to the hauling capacity of wagons, for obvious reasons.

The criterion for good work is fair surface, tightly-laid brick, and avoiding the use of bats wherever possible. Of over 100 bricks, taken up in the different streets, all were laid perfectly tight and firm in their places except three, which I found in a rut in lower Iron St., in a rather exposed position, and these were only comparatively loose. As a rule, the older the pavement, the firmer I found the brick. The beds, wherever examined, came up to the requirements of the specifications.

A correspondent, to whom we are indebted for a copy of this report, states that while he in general agrees with the City Engineer as to the merits of brick paving, he finds a considerably larger amount of wear in some places. Thus on streets which contain double tracks for electric railways very deep ruts are worn by heavy vehicles with ordinary narrow tires. This is due to the fact that the drivers prefer to run with the wheels of one side of their wagons on the tram of the outer rail, thus causing the other wheels to produce local wear and settlement. This is most prominent on narrow streets, where the distance between the outer rail and the curb is almost too small to permit a wagon to be driven on the bricks alone without using considerable care to avoid running into the curb. Our correspondent states that on Walnut St. he measured various places where the ruts caused by driving, as above described, were from 2½ to 3 ins. deep, thus practically destroying the pavement at this point, the bricks of which are only about 4½ ins. wide.

The City Engineer reported this wear as ⅞ in.; and our correspondent thinks that the discrepancy may be due to the measurements given in the report representing averages, while his own observations showed the maximum wear that was found.

Condition of Brick Streets at Johnstown, Pa.; April, 1895.

| Street. | L'gth of street, ft. | Total paving, sq. yds. | Rate per sq. yd. | Total cost. | Date of finishing paving. | Manufacturers and brick. | Contractor. | Wear of bricks, (—ins.—) On st. | Wear of bricks, (—ins.—) In ruts. | General condition. |
|---|---|---|---|---|---|---|---|---|---|---|
| Washington .... | 568 | 2,200 | $2.01 | $4,422 | Oct., '91 | Hoblitzell & Maxwell, "Savage" | J. C. McSpadden | 5/8 | 5/8 | Badly settled; slight ruts |
| Walnut ..... | 641 | 967 | 2.01 | 1,943 | " " | " " " " | " " " | 1/4 | 1/4 | Fair, except ruts 9 ins. wide |
| " ..... | 279 | 927 | 1.39 | 1,289 | Sept., '94 | Mack Co., New Cumberland | " " " | 0 | 0 | " bricks not worn; slight spall. |
| Iron ..... | 783 | 1,566 | 2.01 | 3,148 | Dec., '91 | Hoblitzell & Maxwell, "Savage" | " " " | 5-16 | 5/8 | Local settlements; ruts 8 ins. w. |
| " ..... | 1,100 | 2,599 | 1.68 | 4,366 | June, '93 | John Porter Co., New Cumberland | " " " | 0 | 1/2 | " " " " " " |
| Main ..... | 1,850 | 5,171 | 2.01 | 10,394 | Dec., '91 | Hoblitzell & Maxwell, "Savage" | " " " | 5-16 | 1/2 | Many " " " " " |
| " ..... | 563 | 2,574 | 1.39 | 3.578 | Sept., '94 | Mack Co., New Cumberland | " " " | 0 | 0 | Fair; bricks slightly spalled |
| " ..... | 446 | 2,065 | 1.39 | 2,871 | " " | " " " " | " " " | 0 | 0 | " " " " |
| Clinton ..... | 706 | 1,694 | 1.68 | 2,847 | Aug., '92 | J. Porter Co., New Cumberland | " " " | 0 | 1/8 | " " " " |
| Railway ..... | 785 | 2,974 | 1.68 | 5,310 | May, '92 | Hoblitzell & Maxwell, "Savage" | " " " | 3-16 | ... | Few settlements; no ruts |
| " ..... | 1,385 | 4,640 | 1.06 | 7,859 | Dec., '93 | J. Porter Co., New Cumberland | John Best | 0 | 0 | Fair; bricks slightly spalled |
| Franklin ..... | 500 | 1,560 | 1.68 | 2,631 | " '92 | " " " " | J. C. McSpadden | 0 | 3/8 | Local settlem's; br'ks sligh'y sp. |
| " ..... | 3,045 | 5,790 | 1.59 | 9,206 | Nov., '94 | Mack Co., New Cumberland | " " " | 0 | 0 | Fair; bricks slightly spalled |
| Bedford ..... | 840 | 1,959 | 1.64 | 3,212 | " '93 | James Porter & Bolton, "Globe" | W. A. Park | 0 | 0 | " " badly spalled |
| Somerset ..... | 2,015 | 5,245 | 1.64 | 8,602 | Dec., " | " " " " | " " " | 0 | 0 | " " moderately spalled |
| " ..... | 900 | 2,730 | 1.64 | 4,477 | June, '94 | Park Clay Co., Beaver, Pa | " " " | 0 | 0 | " " slightly spalled |
| Locust ..... | 532 | 1,855 | 1.39 | 2,579 | Sept., '94 | Mack Co., New Cumberland | J. C. McSpadden | 0 | 0 | " " " " |
| " ..... | 855 | 2,350 | 1.39 | 3,266 | " " | " " " " | " " " | 0 | 0 | " " " " |
| Intersection .... | ... | 159 | 1.39 | 221 | " " | " " " " | " " " | 0 | 0 | " " " " |
| Market ..... | 823 | 3,289 | 1.39 | 4,571 | Nov., " | " " " " | " " " | 0 | 0 | " " " " |
| Broad ..... | 3,068 | 10,407 | 1.39 | 14,466 | Dec., " | " " " " | " " " | 0 | 0 | Sigt. settl'g bet. 8th & 10th Aves. |
| Poplar ..... | 286 | 784 | 1.32½ | 929 | " " | H. Swank Co., Johnstown | City | 0 | 0 | Fair; bricks O. K. |
| Totals ..... | 22,000 | 63,518 | .... | $102.198 | ..... | ..... | ..... | .. | .. | ..... |

# ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

*Published every Thursday at Tribune Building, New York.*
*Entered at the Post Office, New York, as Second Class Matter.*

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WM. KENT, E. E. R. TRATMAN, M. N. BAKER, CHAS. S. HILL, A. B. GILBERT.....ASSOCIATE EDITORS.
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F. A. PECKHAM, Chicago.....ADVERTISING REPRESENTATIVES

PUBLICATION OFFICE.....Tribune Building, New York.
CHICAGO OFFICE.....1636 The Monadnock.
LONDON AGENCIES: KEGAN PAUL, TRENCH, TRÜBNER & Co. (Limited), Paternoster House, Charing Cross Road; SAMPSON LOW, MARSTON & Co. (Limited), St. Dunstan's House, Fetter Lane.

*SUBSCRIPTION RATES: United States, Canada and Mexico, One Year, $5.00; 6 months, $2.50; 2 months, $1.00; single copies, 15 cents. To all other countries in the Postal Union, add $2.08 per annum (4 cents per number) to above prices for postage. No club rates allowed. Mailing addresses may be changed at will by sending both old and new address. We shall be obliged if subscribers who fail to receive their papers promptly will notify us without delay. The date when the subscription expires is on the address label on each paper: the change of this to a subsequent date is the only receipt sent, unless by special request.*

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The use of hydraulic shields for soft-ground tunneling is becoming so common that the account of a recent fatal accident in a submarine tunnel in Australia, which was being driven by hydraulic shields and air-pressure, is of much interest to the profession. It is not too much to say that the use of shields has made possible the driving of tunnels which could never have been made without their aid, and the gain in safety which is effected by their use is very great. At the same time this recent accident is an effective reminder that submarine tunneling is a dangerous work, demanding the greatest watchfulness and caution, even with the modern aids of hydraulic shields and the plenum-pneumatic process. In the Yarra tunnel the work seems to have been conducted with most of the usual precautions, but the suddenness with which the break occurred gives rise to conjecture that the important precaution of boring in advance of the excavation in different parts of the face may not have been kept up. On the St. Clair tunnel, which is the largest thus far driven with shields, except the new Thames tunnel now under construction, borings were made in different parts of the face and for a considerable distance in advance of it all through the progress of the work. By such borings the engineer in charge can almost certainly discover dangerous seams of quicksand or other running ground far enough in advance to take all precautions in the way of closing openings in the shield, etc., when the excavation reaches them.

As stated in our report of the Detroit meeting of the American Society of Mechanical Engineers, in our issue of July 4, a resolution was passed recommending that the Council appoint a committee of nine to revise the Standard Code for Steam Boiler Trials, which was reported by a committee of the society about ten years ago. The committee has now been appointed, and consists of the following members: Messrs. F. W. Dean and Geo. H. Barrus, of Boston; Dr. Chas. E. Emery and Mr. William Kent of New York; Mr. Chas. T. Porter, of Montclair, N. J.; Dr. R. H. Thurston, of Ithaca, N. Y.; Mr. J. S. Coon, of Atlanta, Ga.; Mr. Robert W. Hunt, of Chicago, and Prof. W. B. Potter, of St. Louis. Messrs. Emery, Thurston, Porter and Kent are the surviving members of the committee of five which reported the original standard code ten years ago, and the other members of the new committee have been chosen as to include representatives of Western and Southern practice. Ten years ago but little attention was paid in the South and West to the economy of coal, and boiler tests in these districts were of rare occurrence. Now that these sections are waking up to a realization of the enormous wastes that are customary in the use of bituminous coals under steam boilers, and numbers of new furnaces are being experimented with, boiler testing in the West and South promises soon to become as customary as it now is in New England. It is highly important, therefore, that the new boiler-testing code should be so prepared as to be, as far as possible, satisfactory to all interests in these sections, including boiler manufacturers and users and testing experts. The present code has proved of great service in bringing about a uniform and sufficiently exact method of boiler testing, but it has been found open to some criticism lately, especially in regard to its not taking account of the varying calorific values of the bituminous coals. Such defects as it contains will no doubt be remedied in the report of the new committee.

Attention was called in our issue of Oct. 5, 1893, to the need of instructing engineemen not to use their reverse lever in making an emergency stop, if their engine is equipped with a driver brake, as every locomotive should be. In another column of this issue a description is given of some careful tests made to determine this point, which showed conclusively that the engine or train ran farther if the engine were reversed after the brakes were applied than was the case if steam were merely shut off. We believe that superintendents of motive power who have not already done so, will find it well worth their while to carefully instruct their engine crews in this matter, and especially make it clear to them why it is that brakes alone make the quickest stop. Many old runners have grown so accustomed to the reverse lever as the great reliance for a quick stop in an emergency that not until they reach a clear understanding of the reason for its disuse can one be certain that they will not disregard instructions when an emergency actually comes.

The almost continual complaint of scarcity of water now being made by some of the newspapers of Chicago suggests the question, Cannot something be done to reduce waste? In 1893 the city pumped an aggregate of 86,298,474,000 gallons, or an average of 236,434,000 gallons a day. The estimated average population of the city for the year was 1,610,000, which gives a daily per capita consumption of 147 gallons, the figures being from the report of the Department of Public Works for 1893.

On Dec. 31, 1893, there were 4,654 meters in use, an increase of 328 during the year. The number of services is not stated in the report, but the number of yearly bills rendered in 1893 was about 156,000, which would indicate that about 3 per cent. of the consumers were served through meters. Judging from the high consumption and the small number of meters, an extension of the meter system might be made to great advantage.

The Chicago "Inter-Ocean" complains that a large amount of water is wasted in lawn sprinkling. Doubtless there is much waste in this way, and certainly that waste would be lessened if every consumer paid for the actual amount of water used for this purpose. According to the "Inter-Ocean" the only restriction put upon the employment of water for this sprinkling is that the charge shall be $3 for the use of one hose during not over two hours a day. This rate is paid alike by the man with a bit of green on a 25-ft. front lot and the man with large grounds.

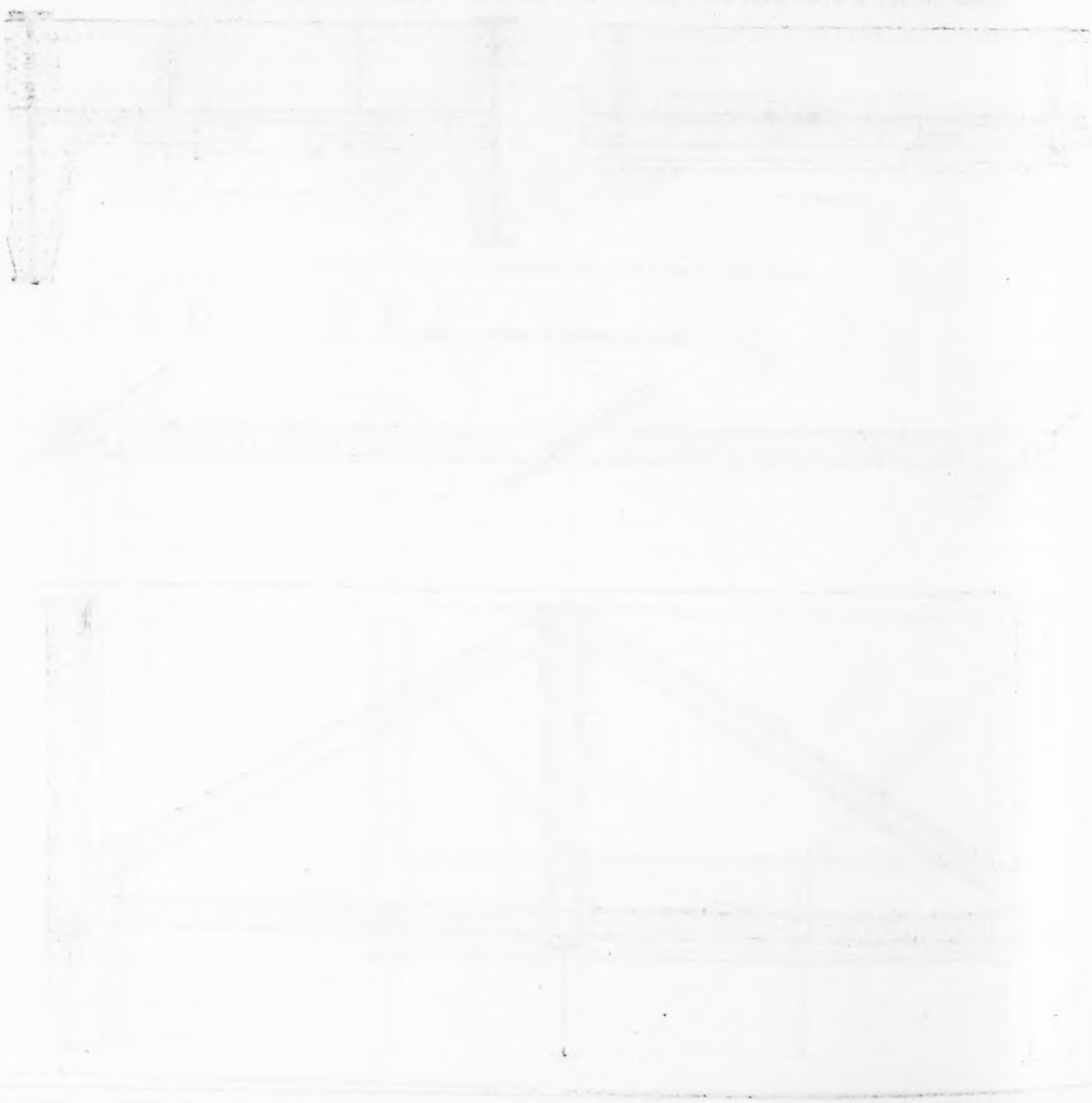
The highest monthly consumption of water in 1893 was 7,992,000,000 gallons in August, while the lowest was 6,475,000,000 gallons in April. The August consumption was about 23 per cent. greater than that for April. In the latter month consumption was probably at its normal, for the three great causes of waste were not then present: (1) Letting the water run to waste to prevent freezing in winter; (2) a like course to secure cool water in summer; and (3) lawn sprinkling, which, it may be added, takes a large amount of water legitimately as well as for wanton waste.

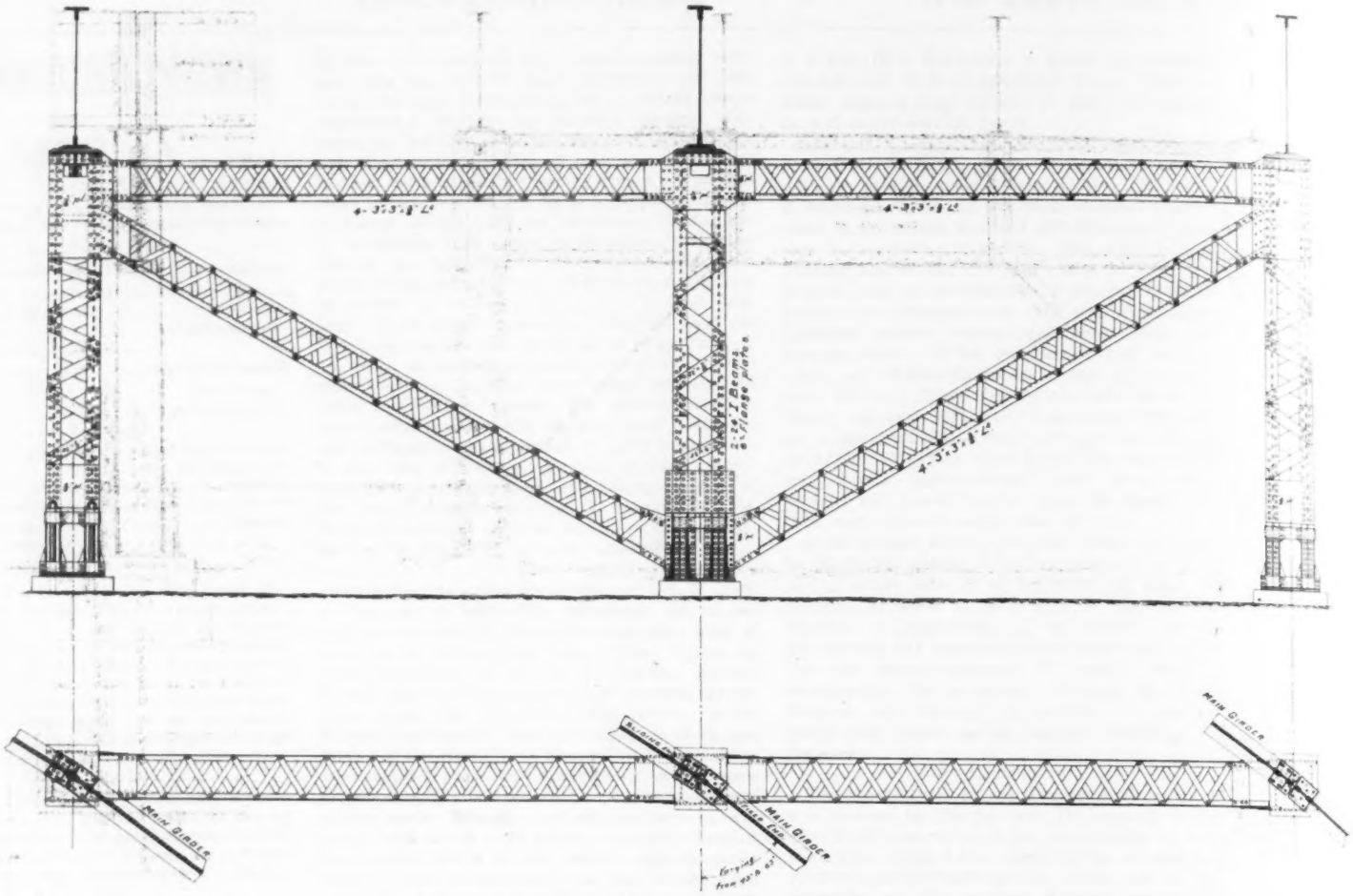
Although Chicago has all Lake Michigan to draw from, its people should not delude themselves with the idea that water costs nothing. For even if increased waste did not mean eventual enlargement of the works, it would still represent a large sum for operating expenses. The average head pumped against for the whole city in 1893 was 112.9 ft., and the average cost of pumping 1,000,000 gallons per foot-head was 5.52 cts. Thus every 1,000,000 gallons wasted cost about $6.23 for pumping alone. If the consumption had been cut down only 50,000,000 gallons a day, which would have still left it at 116 gallons per capita, the yearly saving would have been about $113,000. At 4 per cent. this would have paid the interest on $2,825,000, which could have been expended in water-works improvements where most needed without any greater burden upon the people than they were actually called upon to bear.

Moral suasion alone would not reduce the waste by 50,000,000 gallons a day, so some of the above saving would have to be expended for waste inspection, or either it or a part of the sum represented by capitalizing it, for meters. If the total saving was expended in reducing waste, whatever the means employed, the results would be praiseworthy, for, as already intimated, this would postpone the necessity for greater pumping capacity and larger mains, besides improving the pressure.

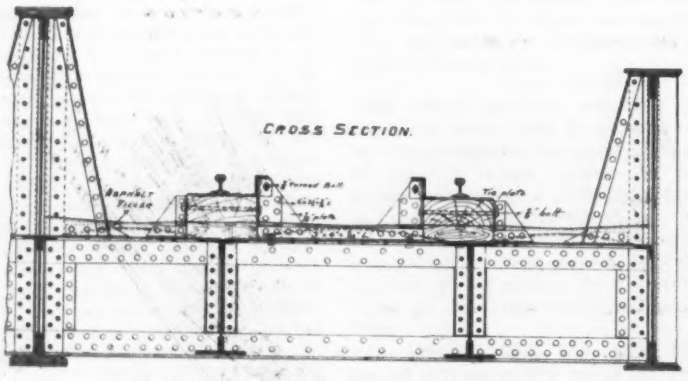
The construction of the Jerome Park reservoir will increase by 200 per cent. the capacity of the distributing reservoirs of the water-works of New York city, giving a total supply in the old and new reservoirs of 3,000,000 gallons. Only half of this, however, will be available without seriously diminishing the pressure. The daily consumption in 1894 was 183,000,000 gallons, of which 170,000,000 was taken from the Croton watershed and 13,000,000 gallons from the Bronx and Bryam drainage areas. If we neglect the flow from the Bronx and Bryam, for which there is a separate 140,000,000-gallon distributing reservoir at Williamsbridge, then when the consumption reaches 200,000,000 gallons, which it probably will by the time the Jerome Park reservoir is completed, this latter reservoir will supply the whole city with Croton water at good pressure for five days, or for twice that time if drawn down to the bottom. The Central Park reservoirs will add 2½ and 5 days, respectively, on the same basis. Thus, without inconvenience, assuming full reservoirs, both aqueducts could be thrown out of use 7½ days, or for 15 days with scanty pressure. With 75,000,000 a day flowing through the old aqueduct the new one could be out of service for 12 days with good pressure, and 24 days with a diminishing pressure during the last half of the period, which could be tolerated only in a great emergency. A description of the new reservoir, with illustrations, is given elsewhere in this issue, and the detailed bids, with quantities and prices, are given in the Construction News supplement.

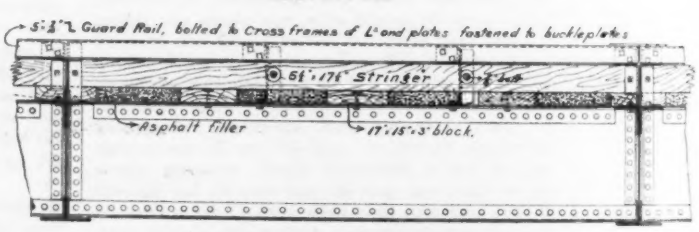
One of the greatest obstacles to the sanitary disposal of garbage is the indiscriminate collection of ashes, tin cans, glass bottles, old clothing and other refuse which finds its way to the garbage can. This mixture of foreign substances with garbage proper is giving rise to many complaints at New Orleans, where a private company is under contract with the city for the collection and disposal of garbage. The company treats the garbage by a utilization process. All foreign substances, like those mentioned, are an incubus to this system, as they contain neither grease nor fertilizing matter, and, in addition, some of them are liable to injure the machinery employed. The company is not obliged to collect garbage containing such substances and the city has an ordinance prohibiting the placing of anything but garbage in the receptacles provided. Notwithstanding this ordinance and in spite of the refusal of the company to take away garbage containing such substances, many householders adhere



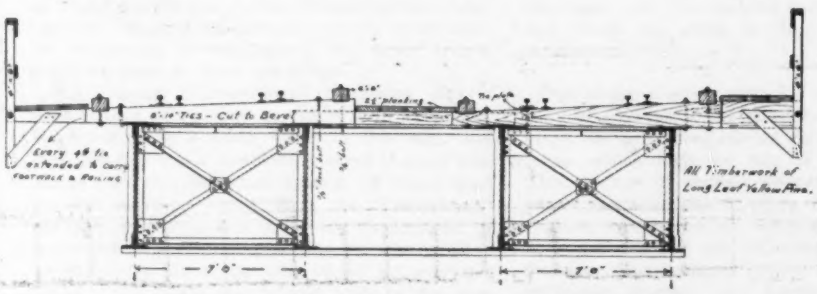



BENTS UNDER THROUGH GIRDERS.





ELEVATION.
5"x3½" L Guard Rail, bolted to Cross frames of L's and plates fastened to buckleplates
6"x12" Stringer
Asphalt filler
12"x12"x3" block.

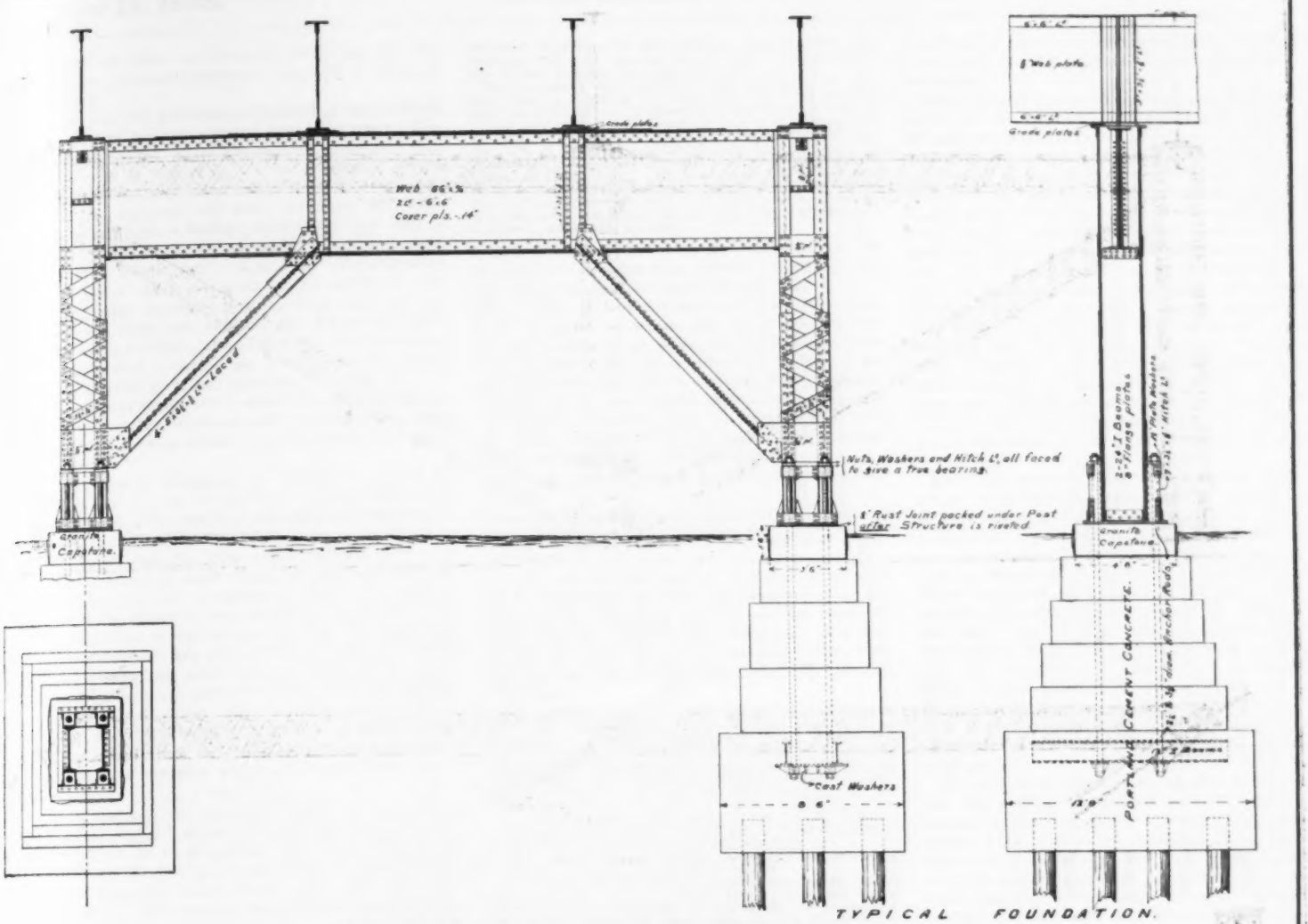
DETAILS OF TRACK SUPPORT ON BUCKLE PLATE FLOOR OVER ST. LOUIS & SAN FRANCISCO R. R. FREIGHT HOUSE.


6"x12" Ties - Cut to Bent
Every 48 ft. extended to carry footwalk & Railing
Tie plate
All Timberwork of Long Leaf Yellow Pine.
7'0"
7'0"

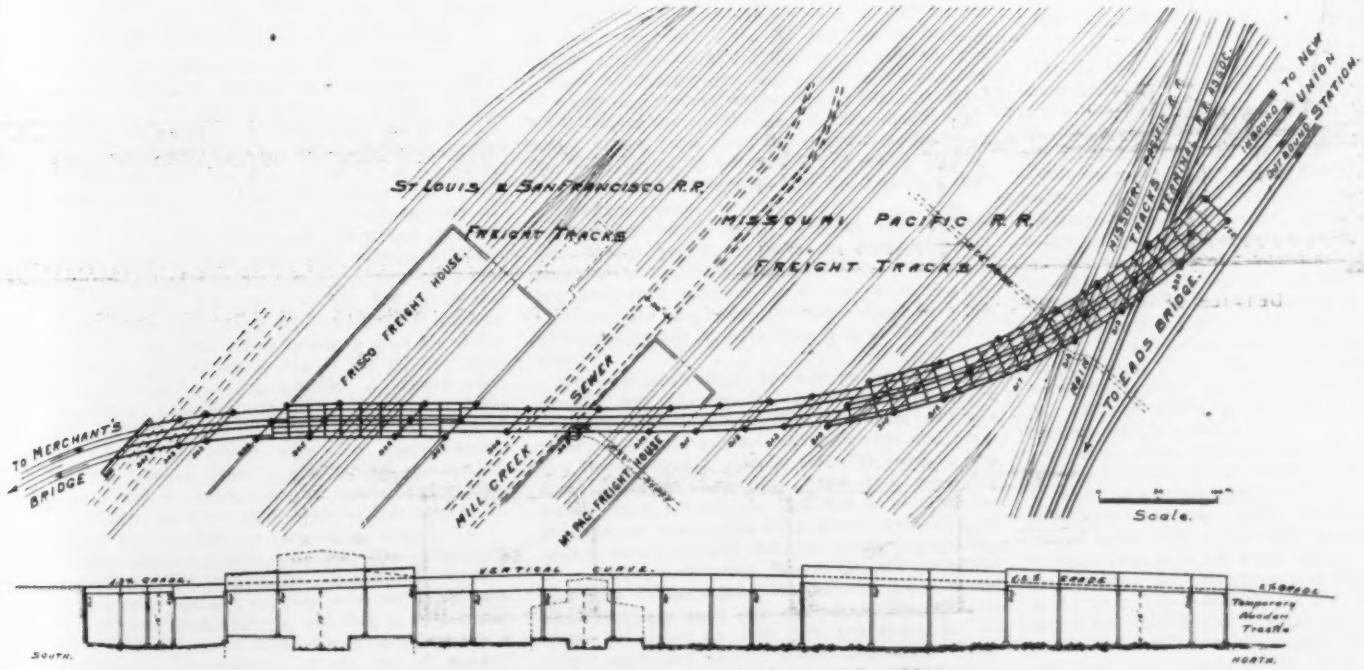
CROSS SECTION SHOWING FLOOR CONSTRUCTION.

## ELEVATED STRUCTURE CONNECTING MERCHANTS' BRIDGE WITH

H. P. Taussig, M. Am. Soc. C. E., Chief Engineer.



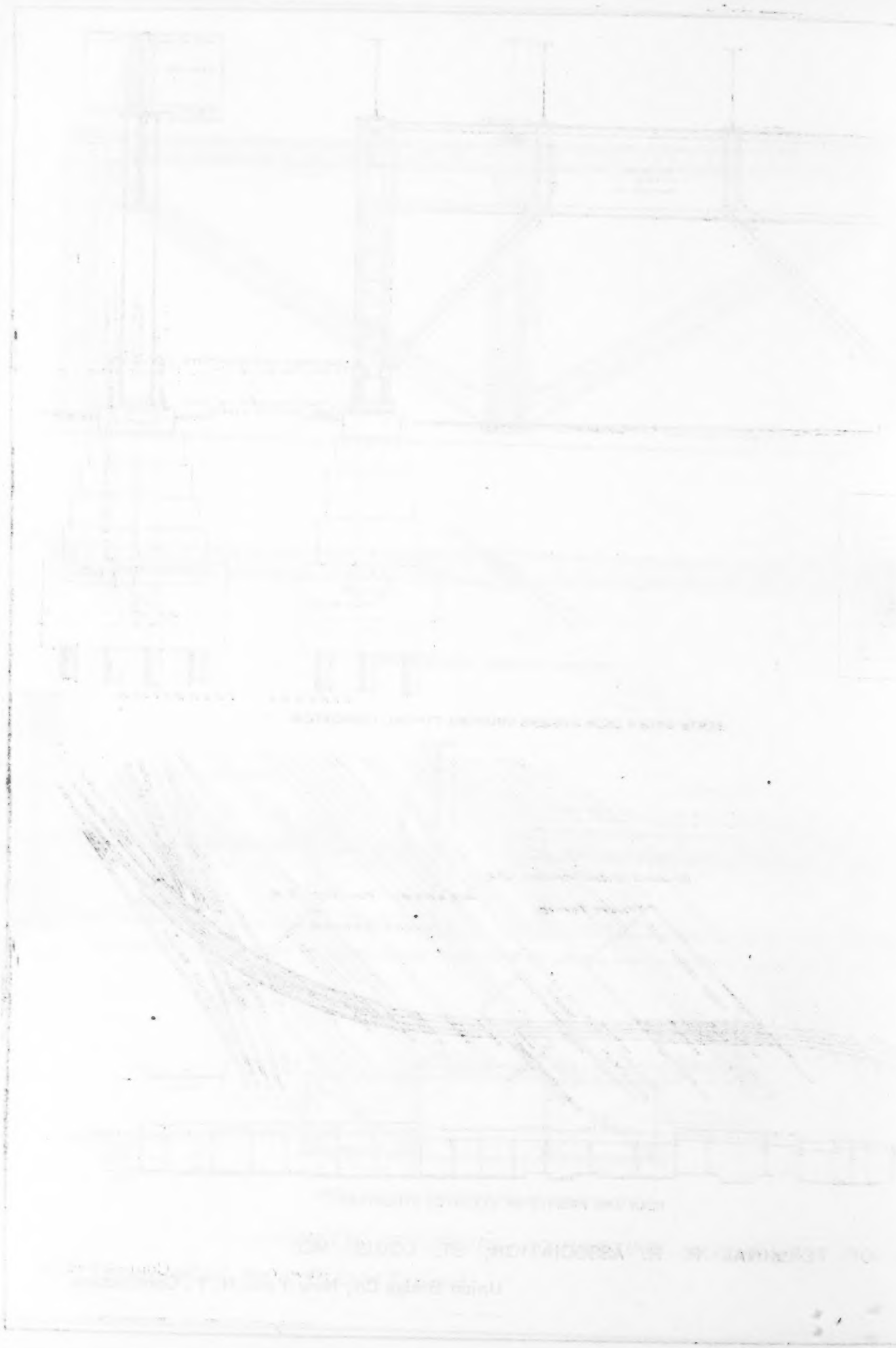

BENTS UNDER DECK GIRDERS SHOWING TYPICAL FOUNDATION.




PLAN AND PROFILE OF ELEVATED STRUCTURE.

WITH TRACKS OF TERMINAL R. R. ASSOCIATION, ST. LOUIS, MO.

Union Bridge Co., New York, N. Y., Contractors.



to the old custom of dumping everything into the garbage can, and complaints are loud if it is not emptied.

Some of the advocates of cremation as a method of garbage disposal welcome such instances as arguments against utilization systems, claiming that such care in separating is not necessary where furnaces are used. But while it is doubtless true that the furnaces will burn or render innocuous everything that is brought to them, it may still be asked whether it is economy to collect, haul and burn matter which, if kept out of the garbage receptacles, needs no treatment to purify it. Certainly ashes should be kept separate from garbage, for coal ashes are valuable for filling and wood ashes as a fertilizer. Paper and rags may be burned by individual householders, or sold; and old bottles may likewise go to the junkman. Tin cans are perhaps the most difficult to deal with of these foreign substances, but if rinsed after emptying they may be stored without offense and removed at infrequent intervals.

Whether a cremation or utilization system be chosen by a city for garbage disposal, then, it is certain that the labor of collection and disposal is greatly facilitated, the value of the by-products is increased, and the total cost of taking care of a city's wastes is least where the refuse matter is assorted by each householder, and only garbage proper is placed in the receptacles provided for it and treated at the disposal works. To teach the householders in any city to thus separate the wastes will require no small amount of patience, perseverance and tact, and no little time will be required to effect the change. But the gains which will result in the systematic disposal of a city's wastes are so great that the reform should be persisted in despite the obstacles which will inevitably be met.

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A circular has just been issued by the Boston Manufacturers' Mutual Fire Insurance Co. over the signature of its President, Mr. Edward Atkinson, which will cause some amusement to engineers who may receive it. The circular opens with the statement that the company has hitherto declined to incorporate boiler insurance with its other obligations, for the reason that

> the risk of boiler explosion is not analogous to the risk of loss by fire, also because the ordinary functions of a boiler insurance company have heretofore been limited to a mere mechanical inspection of boilers without any full consideration of the science of producing steam.

We are in doubt as to what Mr. Atkinson means by boiler explosion loss not being analogous to loss by fire, and it is of no importance anyway. If the company of which he is at the head chose not to insure and inspect boilers, that was their affair; but his slur upon the work of the boiler insurance companies ought not to go unanswered. As a matter of fact, boiler insurance and inspection by reputable companies have been conducted on very similar lines to those which Mr. Atkinson's company has followed in the conduct of the mill insurance business. The policy of the Manufacturers' Mutual Insurance Companies has been to prevent losses by educating the members in systems of fire protection and prevention and by the aid of a careful system of inspection, and this is exactly what the boiler insurance companies have done. Because they undertook the insurance and inspection of boilers was no reason why they should undertake to instruct their patrons in the general science of steam engineering. A mutual organization can widen its scope in matters of this sort to an extent that an ordinary corporation cannot.

Thus, when logically analyzed, Mr. Atkinson's reasons why his company has not gone into the boiler insurance business appears to be really a reason why it should undertake it, and this, in fact, seems to be what he has in mind, for he next proposes a "preliminary investigation of the use of steam," which may lead to his company taking up boiler insurance. We quote from the circular as follows:

> It has fallen to the undersigned to attempt to learn something of the science of the manufacture of steam and its application. He has reached the conclusion that the conditions of this art correspond very closely to those which affected the art of abating friction when the investigation of that subject was first undertaken as a part of the science of preventing loss by fire. On a thorough investigation of the conditions of lubrication at the time this work was undertaken, it appeared that there was a variation of about 250% in the price paid for lubricants, in the quantity used and in the final cost per unit of product in 100 mills, in each of which the manager felt well assured that he fully comprehended the subject and had the best oil in use.
>
> Having looked into the subject to some extent on several visits to England, the conclusion has been reached that the manufacture of steam as a separate art may be better comprehended in Great Britain than it is in this country; there appear to be more definite rules for the selection of boilers, for boiler setting, for the choice of materials in boiler setting, and on many other points than there are here. This may have been brought about in part through the intervention of a Steam Users' Association, which has long been organized in Manchester, England, under the charge of a very distinguished engineer, which also insures.

The conclusion reached by Mr. Atkinson that the manufacture of steam as a separate art may be better comprehended in Great Britain than it is in this country will be a surprise to those New England engineers to whom our whole country has hitherto looked up as being the ablest steam engineers on the globe. It is a surprise to us, for we have believed that the steam engineering of New England in its best cotton and woolen mills was unsurpassed anywhere, and we have possibly paid as much attention as Mr. Atkinson to the status of steam engineering practice in England.

We turn over the page of the circular and we read further:

> The writer himself claims no scientific knowledge of steam engineering, or of anything more than the empirical practice by which nearly all steam users appear to be governed.

Then, why in the name of all that is sensible did he undertake to write this circular? Has his company no consulting engineer, or are there no steam experts in Boston who might have been consulted, and who might have prevented him from thus writing down his own ignorance? The circular continues:

> The undersigned . . . will select two competent men, well trained, and perhaps of some experience in the practice of steam engineering. . . . These two men . . . will be assigned to the duty of developing rules for the manufacture of steam in the safest and best manner. One will be immediately assigned to duty in Great Britain, the other in New England and the Middle States. . . .
>
> . . . The undertaking may occupy twelve months. The results will be put in type and will be distributed among the subscribers to this investigation.
>
> . . . The writer will assume the general supervision of this work as a part of his official duties.
>
> . . . If we do not develop simpler rules for the selection of boilers, we may yet be able to establish better practice in boiler setting—in stoking—in the prevention of smoke, and as the result even of such study of inventions now being applied in many places, we may save a part of the expense of construction of tall chimneys by reducing the height and enlarging the section, and also save a part of the present waste of fuel.

If the investigation (for which a contribution of $3 for each boiler used by the contributors is asked) takes place, and if the "two competent men who have perhaps some experience in the practice of steam engineering," supervised by Mr. Atkinson, who "claims no scientific knowledge of the subject," evolve from their investigation some rules for the selection of boilers and for saving of fuel, it is probable they will receive the attention that their origin merits.

We are curious to know, however, what all this investigation has to do with the inspection and insurance of boilers against explosions. How will Mr. Atkinson's company be in any better position to undertake the boiler insurance business after this investigation is made than it is at the present time?

Mr. Atkinson's logic appears to be this: My company has taken up the comparatively unworked and little-studied field of fire prevention, and has greatly advanced engineering knowledge and practice there; hence it can do a similar work in the field of steam engineering. But this reasoning leaves out of account the fact that in no other department of engineering have greater study and research been expended than in steam engineering. It is quite possible that Mr. Atkinson's investigation may do some good in educating some of the class of steam users who are accustomed to economize by acting as their own engineers; but we do not apprehend that the science and art of steam-making will be materially advanced by his investigation.

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The reported difficulties with the sewage disposal area at Meriden, Conn., turn out on investigation, as set forth in another column, to be due to overdosing the filter beds during the winter and spring, while broad irrigation could not well be practiced. This overdosing was intensified by the fineness of the upper layer of filtering material, which, under the most favorable circumstances, should have received only limited amounts of sewage, applied at intervals.

The principal means adopted to increase the capacity of the beds, making gravel-filled trenches through the fine material and connecting with the coarse below, seems promising. The screens at each outlet to the bed will require much more attention in the aggregate than one screen chamber at the point where the outlet reaches the disposal area, but as a temporary expedient they are cheap and very quickly put up. The removal of 2 ft. of the 3 ft. of fine material on the new beds is certainly a step in the right direction, and the omission of underdrains seems justified, considering the fact that below the remaining 1 ft. of fine material there is a deep bed of sand and gravel, while the water table is reported to be far below the surface. The additional area now being laid out in filter beds will bring the total about up to that proposed by the engineer, Mr. Carrol Ph. Bassett, M. Am. Soc. C. E., for immediate construction when he made plans for the work.

This last point, in connection with the troubles which arose through overdosing the limited area of beds originally constructed, should be a lesson to other cities. It is a lesson which is emphasized by the experience at Westborough, Mass., where, contrary to the advise of the engineer and of the State Board of Health, a limited area of land was only partially prepared for the reception of sewage, and has given rise to difficulties which have as yet been only partially met by further work on the old and the construction of new beds. At Gardner, Mass., on the other hand, unfavorable natural conditions in the way of fine material, and a limited area of land available for use have been largely overcome by following the advice of the engineers employed.

The city of Natick, Mass., appears to be taking the step which has resulted so unfavorably elsewhere. It has just decided to construct only two of twelve acres of filter recommended by its engineer, Mr. S. M. Gray, M. Am. Soc. C. E., and proposes to omit the underdrains from this limited area, all to save expense. Of course, the initial amount of sewage will be small, but, of course also, the engineer had this in mind when he recommended the preparation of twelve acres with underdrains.

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## THE MEASUREMENT OF MOISTURE IN STEAM.

We publish in another column of this issue a paper by Prof. D. S. Jacobus, which has so important a bearing upon current practice in the installation and testing of steam plants that some explanation of the matter seems advisable.

Wet steam is objectionable, first, because if the moisture is present in such quantity that it may concentrate into the form of a stream of solid water, it may collect in the clearance space of an engine cylinder and cause the wrecking of the engine; second, because the water entrained in the steam carries heat away from the boiler, of which a very small fraction, if any, is converted into work in the engine; third, because in a boiler test the moisture in the steam, if not accurately determined and allowed for, causes an error in the results of the test, and may lead to a boiler being considered more efficient than it actually is.

Of these three objections to wet steam the first two are usually easily overcome by the simple device of inserting a steam separator in the steam pipe between the boiler and engine, and returning the separated water back to the boiler by means of a trap, a steam loop or a hot water pump. The third objection—viz., that the presence of moisture in steam leads to a false estimate of the evaporative capacity and efficiency of a boiler—or, in other words, to the falsification of the results of a boiler test, has been well understood for many years. Prof. Thurston's experiments, in 1871, with five different boilers, showed that the moisture in the steam varied from 3 to 6.9 per cent., while Hirn's experiments at Mulhouse showed an average of 5 per cent. To overcome the objection, the so-called "calorimeter tests" have been made to determine the percentage of moisture in the steam as it issues from the boiler, such percentage being deducted, as a correction, from the apparent quantity of water

evaporated. The calorimeter tests were in nearly all cases made by taking a sample of steam from the main steam pipe by inserting a piece of perforated half-inch pipe into the main pipe, the steam thus led into the perforated pipe being taken without question as being a fair average sample of the total volume of steam, moist or dry, flowing in the pipe.

In the early experiments of Hirn and Thurston, instead of such a sample being taken, the whole amount of steam discharged by the boiler was passed through a surface condenser and completely condensed. The data of the test were: the pressure and temperature of the entering steam; the temperature and the weight of the water condensed from the steam, this weight, if there were no leakage, being the same as the weight of water pumped into the boiler; the weight and the temperatures at entrance and exit of the condensing water. From these data, with a table of total heats of steam and water, a simple algebraic formula gave the percentage of moisture.

The difficulty of providing surface condensers, condensing water and apparatus for weighing and measuring the great quantity of water used for condensing the total amount of steam generated by the boiler under test, is so great that few experiments have ever been made by the method of total condensation. The system of condensing a small sample was universally substituted, and the "barrel calorimeter," in which about ten pounds of steam were condensed in a barrel containing about 300 lbs. of water, became the apparatus usually adopted. Ten or twelve years ago, when careful tests made with the barrel calorimeter showed that it was liable to give an error of two or three per cent. of moisture in the percentage determined by it, the "coil calorimeter" came into vogue. This was a modified surface condenser, and very uniform results were obtained by it, but it was expensive and troublesome to manipulate. More recently the superheating, the wire-drawing and the separating calorimeters have been invented by Mr. Barrus, Prof. Peabody, Prof. Carpenter and others, and these, especially the wire-drawing calorimeter, have given results so accurate, with apparatus so inexpensive and so easily handled, that they have practically superseded all the earlier forms.

Now, just as engineers had comfortably settled themselves in a belief that the determination of the moisture in steam in a boiler test was a very easy operation, whose accuracy was just as great as that of reading a good mercury thermometer, along comes Prof. Jacobus with his experiments in sampling steam, throwing doubt upon all tests of moisture that have ever been made, whether by barrel, coil, wire-drawing or other form of steam calorimeter, in which a sample of steam only was taken from the steam pipe to be tested. He not only shows that our method of sampling is all wrong, but that no possible method of sampling can be right. The sampling of steam for calorimeter tests must apparently be given up, but we cannot avoid the necessity of determining the moisture in steam if we wish to know accurately what is the evaporative capacity and efficiency of a steam boiler. Some substitute for the sampling method must therefore be found.

Fortunately, recent experiments on steam separators show that it is quite easy to find a separator which will reduce the moisture in very wet steam down to one per cent. This fact would seem to indicate that a practically accurate method of determining the moisture in steam would be to insert an ordinary steam separator in the steam pipe just after it leaves the boiler, and remove by it nearly all the moisture, trapping the amount and weighing it, and then to determine by the method of sampling, with a wire-drawing calorimeter, the moisture yet remaining in the steam as it escapes from the separator. The sampling method is probably sufficiently accurate for a determination of the small fraction of moisture remaining in the nearly dry steam if the sample is taken just after passing the separator.

In existing plants a boiler test, including a determination of moisture by the separating method, may involve some trouble in cutting out a portion of the steam piping for the insertion of a separator, but in new plants provision might be made for the insertion of a separator in the rising pipe leading from the boiler to the steam main, and for the purposes of test, facilities should be afforded for cooling and weighing the water trapped from the separator. This subject will no doubt receive attention from the committee on a standard code for boiler tests, recently appointed by the Council of the American Society of Mechanical Engineers, which we have mentioned in another column in this issue.

It must not be overlooked that the results of Prof. Jacobus' tests make necessary a careful review of all our supposed knowledge concerning wet and dry steam. Great numbers of calorimeter experiments made by the sampling method have shown apparently that the ordinary form of horizontal tubular boiler, and the forms of water-tube boilers which have long horizontal drums, giving large disengaging surface, rarely show over one or two per cent. of moisture in the steam, unless they are overdriven, or unless the water contains substances which cause foaming. Prof. Jacobus' results, however, throw doubt upon all these calorimeter tests, and make it necessary that we should hold our views as to the dry steam-giving properties of these types of boilers in abeyance until new experiments are made by the method of separating out all the water in the steam.

On the other hand, tests have occasionally been published in which an excessive amount of moisture in the steam has been shown. It has been said of certain types of water-tube boilers, for example, that they would give steam containing 10 to 20 per cent. of moisture, if worked up to their rated capacity. But in the light of Prof. Jacobus' experiments, it seems safe to say that all calorimeter tests which have showed an abnormally high percentage of moisture in the steam should be looked on with extreme suspicion. It is entirely possible that boilers have been unjustly condemned by such tests in the past. The experiments of Prof. Jacobus also lead to an important conclusion concerning steam separators—viz., that it is not as difficult to separate steam from water as has hitherto been supposed. A simple, sudden change of direction of the flowing current may be sufficient, and even a straight horizontal pipe may become a separator, the water in the steam falling to the bottom of the pipe and running along it in a small stream, which may easily be run into a pocket and removed, while the upper portion of the pipe contains practically dry steam.

## LETTERS TO THE EDITOR.

### MECHANICS OF THE FERRIS WHEEL—CORRECRECTION.

Sir: Will you kindly correct the misprints in the formula at the foot of the third column of p. 10 of your issue of July 4, by reprinting it in full, as follows:

$$\sin\alpha + \sin 2\alpha + \sin 3\alpha + \ldots + \sin n\alpha = \frac{\sin\frac{(n+1)\alpha}{2}\sin\frac{n\alpha}{2}}{\sin\frac{\alpha}{2}}$$

Sincerely yours, I. P. Church.

York Beach, Me., July 12, 1895.

### WORK DONE BY STREET SPRINKLING WAGONS.

Sir: I have been looking over back volumes of Engineering News and a few municipal reports, with a view to securing some information on the subject of service of street sprinkling wagons, in order that I might compare the results obtained in other places with those obtained here. The results of my search have not been satisfactory, as I have not found figures so arranged as to admit of a definite comparison. Some results are expressed in cost per mile of street sprinkled, others in cost per square foot, nearly all ignoring the matters of width of street or number of times sprinkled per day. The true measure of service, it seems to me, should be the number of loads (and consequent number of gallons) of water put out per team per day, regardless of whether this water is used for sprinkling several streets once per day or one street several times per day. We have several teams in use, all sprinkling under different conditions and obtaining different results. Our best service comes from a team located on one of the main streets of the city. The regular duty of this team is six loads of 750 gallons each per hour. The distance covered is 8,100 ft., and the amount of water used is 4,500 gallons. This is not a special test figure, but is the regular working rate kept up for ten hours per day, month after month. I believe the results are better than those generally obtained throughout the country; if so, they are simply due to a careful attention to details and are readily within the reach of others. I submit the figures as offering to others an opportunity for comparison, and would be glad to hear from any who may be doing better. Very truly, James W. Johnson,

City Engineer.

Riverside, Cal., June 28, 1895.

(The amount of water spread by a sprinkling wagon in a day of ten hours would certainly be a desirable unit provided the flow from the wagons used in different cities is approximately uniform. We are doubtful whether such a uniformity exists, even among different sprinkling wagons in the same city. In fact, uniformity would not be desirable. On a stone or asphalt pavement a very small amount of water is as good as more; a macadamized street will stand a considerably larger amount without waste, and a gravel road will take still more. On the other hand, a given street surface will require more frequent sprinkling to keep in proper condition in a dry climate than in a damp one. Perhaps no unit would express so well the relative work done by different sprinkling wagons as the total distance traveled per day by each wagon, to be determined by attaching a cylometer to the wheel hub. This figure taken with the total amount of water spread would well indicate relative efficiency.

On the other hand, while this is a useful figure to the superintendent in charge of the work, the property-owner naturally wants to know the cost per square foot or square yard of street kept sprinkled; hence it seems to us both figures should be given by city engineers in their reports.

In view of the dearth of figures respecting cost of street sprinkling, it would be of general benefit if city engineers who have charge of this work would state in their annual reports the length, besides the figures noted above, width and total area of the streets kept sprinkled, the frequency of sprinkling, total amount of water used and the amount per square foot of area served; the capacity of each sprinkler in service and the work done by each in gallons of water spread, actual area served and total distance traveled. The total cost of sprinkling service distributed under the heads of water, labor and repairs would also be of interest.—Ed.)

### CURVATURE ON SHIP CANALS.

Sir: Among the many articles that have been written on the subject of ship canals, your recent notes on the North Sea Canal were the first to mention alinement, to my knowledge. "Engineering's" reprint of the Manchester Ship Canal refers to the sharpest curve on the canal by text and cut, but fails to state either the degree or amount. Can you tell me where that information can be obtained, and can you give facts concerning the alinement of the Suez Canal, the Panama and the Nicaragua? Yours, etc.,

Eugene Ricksecker.

U. S. Engineer's Office, Seattle, Wash., July 5, 1895.

(Owing to a seeming disregard of these features in the many published accounts at hand, it is impossible for us to exactly state the total amount of curvature on the several ship-canals of the world. The minimum radius is now accessible; but the surface and bottom widths are not given in their relation to curvature, except in the case of the Baltic Canal. As near as can be computed from accessible reports the minimum radii of these canals are as follows:

| Canal. | Length, miles. | Radius of sharpest curve, ft. |
|---|---|---|
| Manchester | 35¼ | 1,980 |
| Suez | 99.9 | 2,000 |
| Nicaragua | 170 | 2,528 |
| Panama | 45 | 2,000 |
| Baltic | 61½ | 3,289.87 |

Of the above canals, the sharpest curve on the Manchester Canal is at Runcorn, according to the report of Mr. Thomas Monro, the Government Engineer. On this canal there are 15 miles of curves and 20½ miles of tangents. On the Suez Canal the channel curve in Lake Irnisah includes an angle of about 90°; but vessels 400 ft. long and 65 ft. beam passed it before the canal was widened and deepened. On the Nicaragua Canal location the sharpest curve was in the approach to the Divide Cut; but we believe this location has since been changed

slightly and the curvature is now less than is stated in the table above. On this canal location about one-third of the total distance, or about 56 miles, is curved, but with the one exception named the curves range from 4,000 to 6,000 ft. in radius. The maximum curvature on the Baltic Canal is 3,000 m., or 9,842.61 ft. Of the alinement of the Panama Canal we can find no trustworthy information, other than a single reference to 2,000 ft. as a minimum radius for curvature. We should be pleased to have this table corrected and extended by those of our readers having further data upon this head.—Ed.)

### STRESSES IN PLATE GIRDERS.

Sir: I have read, with much interest, Professor Johnson's able discussion on the stiffening angles of plate girders, published in your issue of April 25. His explanation of the function of the solid webplate and its stiffeners seems to me not only entirely sound in theory, but, what is even more important, an eminently safe and useful guide in designing.

The distribution of the stresses in plate girders is very complicated, and no theory so far advanced gives an entirely satisfactory explanation of their action. It is only by an extended series of actual tests on large girders, made under competent direction, that we can hope to obtain exact information as to the strength of these girders and their constituent members. Such tests have never been made on a sufficiently large scale, to allow any important conclusions to be drawn from them.

In the mean time, we are obliged to depend on such deductions as can be drawn from the behavior of bridges in every-day use. The results thus obtained are, unfortunately, mainly negative, as their great excess of strength makes failure in plate girders or any of their details of very infrequent occurrence. Plate girder bridges are now built of 100 ft. span, or even more, so that the loads and stresses involved are of considerable magnitude. For this reason details and methods of proportioning which are satisfactory for shorter spans, frequently need revision when applied to these large girders.

With regard to the webplate in particular, it is found that the forces which tend to buckle and distort it increase very rapidly with the depth of the girder. Both theory and actual observations lead us to the conclusion that the web is practically in a kind of unstable equilibrium, though the exact nature and magnitude of the forces acting on it are not determinable. It may, in this respect, be likened to a slender column in compression, or a cylindrical tube under external pressure. In all these cases, there are unknown elements, such as the eccentricity of the forces, or the lack of homogeneity in the material, which introduce lateral deflections and tend to cause failure.

In the case of the webplate, there are two ways of resisting this tendency to buckle. The first consists in making the web of sufficient thickness that its own stiffness alone will be sufficient to prevent bending; the second is to obtain the necessary rigidity by attaching to the plate special stiffening angles, or their equivalent.

The decision as to which of these methods should be selected in any given case, depends on the size of the girder, the relative cost of shop labor and material, and other local conditions.

It is a fact, established by long experience, that even a thin plate, if securely fastened at the top and the bottom, possesses considerable stiffness, and instances are very rare where failure in plate girders has occurred through the buckling of the web, even where it has become much reduced in thickness by corrosion. For this reason, in girders of moderate depth and length, the usual minimum thickness of ⅜ in., adopted for practical reasons, will usually require but little reinforcing by stiffeners to give entire safety from collapsing. In fact, there can be no doubt that many short girders have been and are being built with unnecessary complication, from an excess of prudence. Where stiffeners are used on such girders they should be spaced rather far apart, and be of moderate size; they would naturally be fastened in a vertical position. In long and heavy girders for railroad traffic, the provisions for resisting the buckling of the web must be more carefully considered. The webplate is but little thicker than in shorter spans, so that the ratio of thickness to depth is very much increased. In this case, the stiffeners must consist of heavier angles and be placed close together. I have found it advantageous to give support to deep and slender webs, by placing vertical stiffeners at moderate distances, and, in addition, riveting a diagonal angle across each panel, where the shear is of considerable amount—i. e., near the abutments. The unsupported surface of the webplate is, in this way, reduced to a series of triangles of moderate size, which are not easily deformed.

To build girders over 5 to 6 ft. in depth, with the usual rectangular web panels, seems to me unadvisable, as a considerable increase in stiffness can be readily obtained by the use of inclined stiffeners.

I enclose herewith the plans of two plate-girder spans, built with the detail described above, out of a considerable number designed and erected by me some years since as Bridge Engineer of the Kansas City, Fort Scott & Memphis R. R.

The 50-ft. span is a deck girder 5 ft. in depth, built to carry a moving load of 4,500 lbs. per lin. ft., with tensile flange strains of 7,500 lbs. per sq. in. There are four vertical angles over the abutment, with inclined stiffeners in the last panel.

The longer span is a through girder bridge, 100 ft. in the clear, and has an iron floor system. As the shear is a constant between the abutments and the first floor beam, the system of inclined stiffening angles is continued as far as this point.

In both of these designs, the end shear is transferred from the web to the bedplates on the abutment, by reinforcing plates riveted to the webplate and bearing with their edges on the bottom chord angles.

The additional cost of these details is quite inconsiderable, as compared with the ordinary forms, and no especial difficulty was encountered in their manufacture. Yours truly,

Henry Goldmark, M. Am. Soc. C. E.

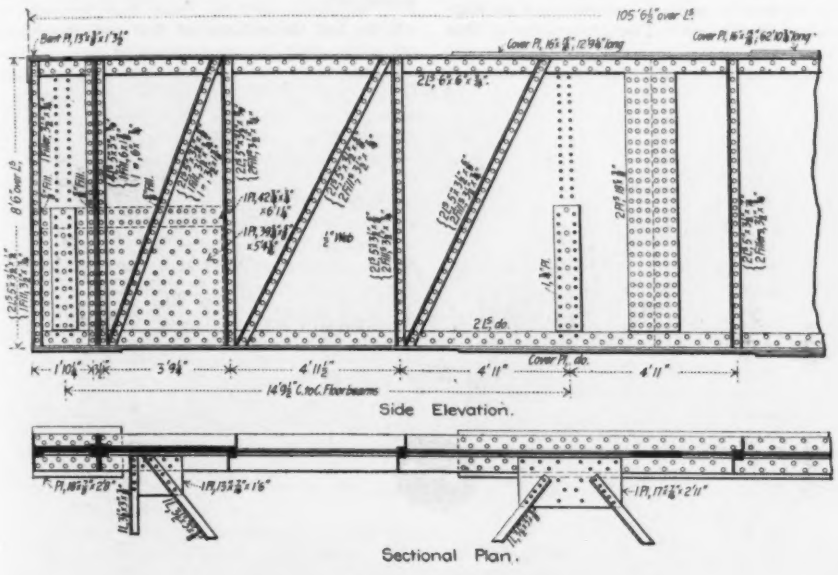
Chicago, June 1, 1895.

### AN ACCIDENT IN A SUBMARINE TUNNEL.

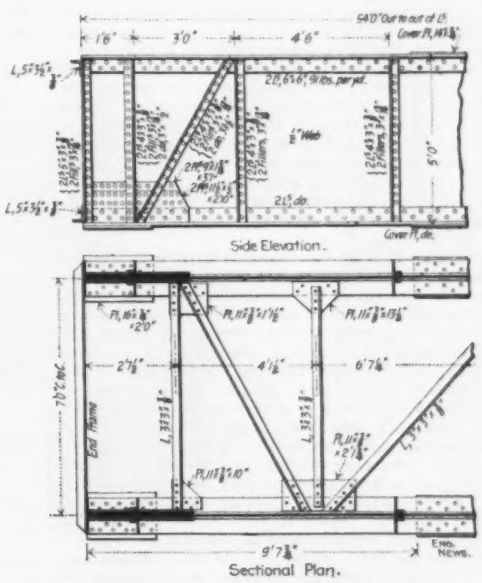
The first great accident ever recorded in submarine tunneling with a hydraulic shield occurred in April last at the sewer tunnel being constructed under the river at Melbourne, Australia, but no news of the accident seems to have found its way to the technical press at the time, and we find the description given below in the "Indian and Eastern Engineer" of June 1. Some men were in the air lock, preparing to enter the tunnel, when they saw through the peephole the engineer in charge running from the heading towards the lock, but before they could open the door he was overwhelmed by the water which had broken into the headings. Six men were killed. We shall give some particulars of the Melbourne sewerage system and the Yarra tunnel in a later issue, but in the meantime we reprint our contemporary's account of the disaster as follows:

On Good Friday a painful accident occurred in the main sewer at Spottiswood, Victoria, of the Metropolitan sewerage system of Melbourne.

The scene of the occurrence was that section of the works for which Mr. A. T. Robb is the contractor. Six men working in the face of the tunnel under the Yarra river were drowned as they worked by the collapse of the river bed. Mr. Robb's section begins at the north bank of the Yarra, and the first step he had to take was to make a shaft 61 ft. deep, from which he might drive beneath the bed of the stream. The tunnel is 11 ft. in diameter, and is lined with iron plates, 1¼ ins. thick, which are bolted and calked, so as to be air and watertight. As each section of lining was placed in position a shield was driven forward by hydraulic pressure, so as to protect the tunnel from being flooded by the sand drift. The tunnelling had progressed nearly to the center of the river, a distance of some 480 ft. from the shaft. At this point, on April 12, at 3 o'clock, a gang of seven men went on duty to work a shift of eight hours. There are three shifts, and the operations proceed continuously. They were accompanied by Mr. John Buchanan, the civil engineer in charge, who had been down the tunnel nearly the whole of the day, and he remained at the foremost point of the workings until the end. Nothing extraordinary occurred up to 7:50 p. m., the indications being of the same character as had prevailed all day. At that time all was made ready to place another section of the lining in position. The fitter employed in that shaft then left the place where he was working, and went up the shaft for the purpose of getting the iron lining. He obtained it, and returned towards the tunnel with it, the brakeman and Mr. John Watson, the Inspector of the Metropolitan Board of Works, accompanying him. Reaching the air lock, the party passed inside, pushing the truck which carried the lining—about 2½ tons in weight—before them. The door of the lock was closed, and then directions were given to charge the chamber with compressed air, so that the door which gave entrance to the workings in the face might be opened. The work was proceeding as fast as could be, when Hoard, a fitter, saw through a glass plate in the door a man come




End Panels of 100-Ft. Span Through Plate Girder Bridge.




End Panels of 50-Ft. Span Deck Plate Girder Bridge.

## PLATE GIRDERS WITH INCLINED WEB STIFFENERS ON END PANELS.

Designed by Henry Goldmark, M. Am. Soc. C. E., for the Kansas City, Fort Scott & Memphis R. R.

hurriedly to the door opening from the tunnel into the air lock. He swung back the "dog" which secures the door in such a way as to fasten it. There is little doubt that he thought the door was fastened, and moved the "dog" whichever way it would go, so as to free it. The next moment Mr. Buchanan came towards the door, swinging a light in a hurried manner, meaning, as Hoard took it, to hurry him up in getting the door open. Before Hoard could make a reply the whole of the interior of the tunnel appeared, as he phrases it, "to go black," and he saw the water rise up over the glass in the door, and all was over. There was nothing he could do then except give an alarm and return to the head of the shaft. It was impossible to open the door leading to the tunnel then, and even if he had done so, the result would have been to flood the whole place, including the shaft. Nor did the man's mistake in turning the "dog" the wrong way operate to detain him, because he could not have opened the door under any circumstances after the workings had collapsed and the compressed air in the face of the drive had escaped.

The works are situated due east from the Spottiswood railway station, and form the most important link in the sewerage scheme of Melbourne and suburbs, because they will constitute the gathering grounds of the millions of gallons of drainage that daily flow from the business places and private houses of the metropolis. In a word, the whole of the drainage will flow into an immense and deep excavation, whence it will be raised by means of a powerful Worthington pump to the surface, and be thence forced along a raising main until the sewage reaches a sufficient height to flow by gravitation to the sewerage farm at Werribee. The contract is what is known as a "short length," and, starting almost from the pumping-house on the Spottiswood side, passes beneath the bed of the Yarra and terminates at a distance about a quarter of a mile from the Port Melbourne bank. Sufficient progress had been made to bring the working party almost exactly to the center of the riverbed, the shield system of working being adopted. The special shield employed is of the type known in England as the "Greathead," and was especially imported from England for the work.

The construction of the tunnel is beset with greater difficulties than had to be faced in tunneling under the Thames, in London, or the Mersey, at Liverpool, for in those places the tunnels passed through firm rock and earth, alternating with a chalky formation, which rendered the work of excavation comparatively easy and safe. The test bores put down by the engineers of the Board showed that for some distance under the bed of the river the earth was of a treacherous nature right across the stream—that it was composed of sand, intermixed with clay, and alternating with a "peaty" like substance. To tunnel through this would be exceedingly difficult and dangerous, owing to the probability of the sand "running" and allowing the river to burst into the workings. Hence it was decided by the contractor to adopt every precaution against an inburst, not only for the safety of the lives of the workmen, but also in his own pecuniary interest, as an inrush of water would mean a heavy loss. The shaft from the bottom of which the tunnel is being driven from the western to the eastern side of the river is 61 ft. deep. It is excavated 11 ft. in diameter, but as there is a concrete wall one foot thick, this reduces the tunnel to 9 ft in the clear. Taking the depth of the river and that at which the tunnel is being driven, there is 12 ft. of earth between the top of the tunnel and the bed of the stream. It was considered that the excavation could be safely made even through the sand by forcing an iron shield, the size of the tunnel, ahead of the workmen, who could then remove the sand. Briefly, the shield formed an impenetrable protection; as it gradually ate into the soil it was moved forward, the space behind it was lined with brickwork and cast iron segments. But from the first the nature of the soil—a mixture of sand and loose clay—caused perpetual trouble, and it was found absolutely necessary to resort to the expedient of working in air sufficiently compressed to successfully resist the crumbling in of the face.

It is stated that the opening in the front of the shield was 6 × 4 ft., and was provided with doors. The air pressure was about 14 or 15 lbs. when the accident occurred. The depth of the water over the tunnel is not stated, but the divers who investigated after the accident claimed that there was a distinct groove along the bottom of the river, which appeared to be made by a vessel's keel. Accepting the statement that there was 12 ft. of earth between the tunnel roof and the river bottom, it would appear that the total depth to the tunnel center was perhaps 36 or 37 ft. Thus the air pressure was within one or two pounds of balancing the hydrostatic head over the tunnel. The accident apparently occurred through the excavation striking a vein of fluid quicksand or other loose yielding strata, which rushed into the tunnel before the doors in the shield could be closed.

After the flooding of the tunnel a diver examined the break and found a cavity some 10 ft. in diameter and 9 ft. in depth in the river bed directly over the face of the shield. Air was still escaping from the face, and a 3-in. vent pipe had to be inserted to permit the escape before a large tarpaulin could be spread over the hole. Some 500 bags of clay were then dumped in the hole under the diver's direction, and the whole was covered with a couple of scowloads of clay. This effectually sealed the opening, and the air pressure was again run up, and the tunnel was drained three days after the accident occurred. The bodies of the victims were found near the air lock. The shield was about 2 ft. 9 ins. back from the face of the heading, and the hole through which the water had come was near the center of the face. We have commented on this accident in our editorial columns.

## A COMPUTER FOR DETERMINING FLOW IN PIPES BY KUTTER'S FORMULA.

We have several times illustrated and described the ingenious computers or circular slide rules designed by Mr. Wm. Cox for performing various complicated mathematical operations. We show herewith a computer which he has designed for determining the flow in pipes in accordance with Kutter's well-known formula. The advantages of this formula in point of accuracy are generally conceded by engineers, but as it is somewhat complicated to apply in practice, it is not as generally used as it might well be.

All such difficulty is obviated, however, by the use of the mechanical computer shown herewith. The computer consists of three parts—a foundation plate, a revolving disk and a revolving segment, each one provided with the different graduated scales which represent the various factors of the formula:

$$\text{Velocity} = C\sqrt{R.S} \quad \text{and}$$
$$\text{Discharge} = A\ C\sqrt{R.S}$$

reduced to the form:

$$C\sqrt{\frac{d}{4}\times\frac{H}{L}} \text{ and } A\ C\sqrt{\frac{d}{4}\times\frac{H}{L}}$$

the value of C being based on slopes of 1 in 1,000 and three different internal conditions of pipe corresponding to the following values of N in Kutter's formula, namely:

N = 0.011 for iron pipes well jointed and in best order;

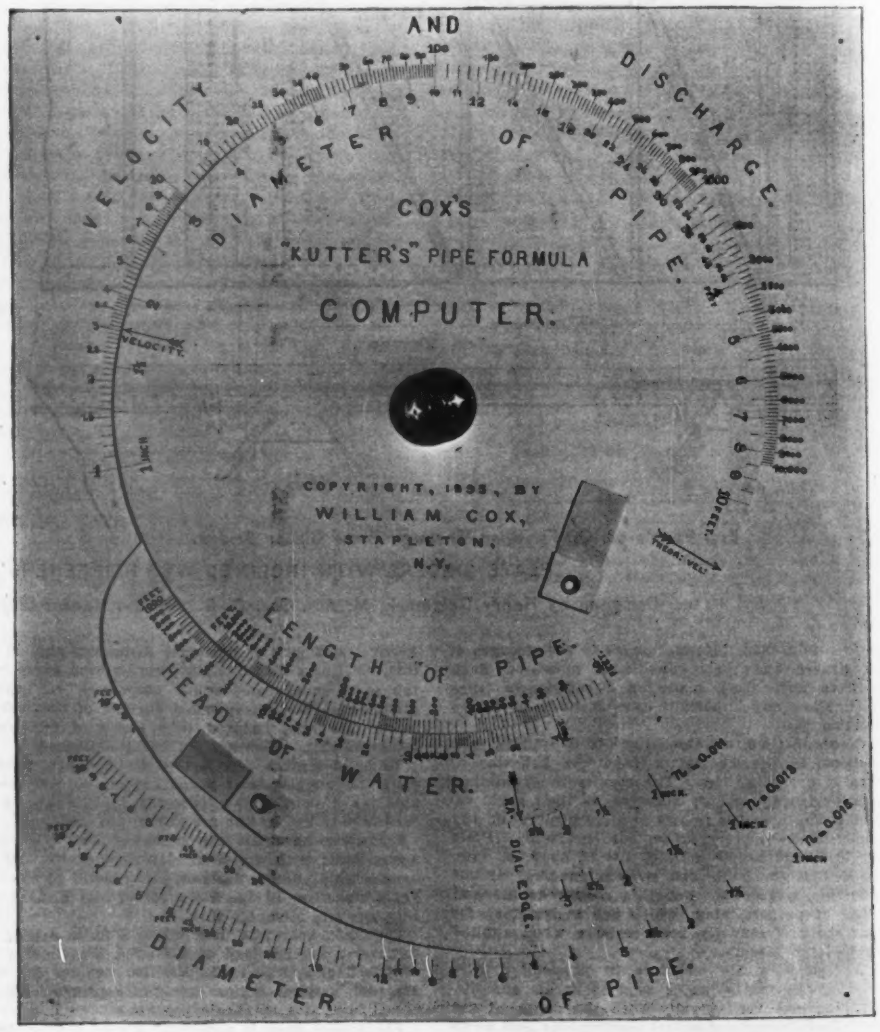
N = 0.013 for ordinary iron pipes in good condition, but not new; and

N = 0.015 for iron pipes foul and slightly tuberculated.

These values of C are practically the same for all steeper slopes than 1 in 1,000, so that they may be said to cover all the requirements of pipe lines, while the valves of N are also applicable to pipes of other materials whose inner surfacees are equally rough.

The method of using the computer, which is exceedingly simple, is clearly shown by the following examples:

1. To find the velocity of flow and the discharge:




COX'S COMPUTER FOR DETERMINING THE FLOW OF WATER IN PIPES BY KUTTER'S FORMULA.

(a) Set the radial edge of the segment to the diameter on the scale corresponding to the selected value of N; (b) Bring the length of pipe on the disk to the head of water on the segment; (c) Opposite the upper arrow on the disk find the velocity in feet per second, and opposite the diameter of the pipe on the disk find the discharge in cubic feet per minute, both on the foundation plate.

2. To find the diameter of pipe for a given discharge, the required velocity of flow being previously deter-

mined: (a) Set the upper arrow on the disk to the required velocity; then (b) Opposite the given discharge on the foundation plate find the diameter of pipe on the disk.

3. To find the diameter of pipe which will discharge a given quantity of water, no velocity being previously determined: (a) Set the length of pipe on the disk to the head of water on the segment; then (b) turn the disk and the segment round together, until the same diameter is opposite the required discharge on the foundation plate and opposite the radial edge of the segment on the scale of diameters corresponding to the selected value of N. This is the required diameter. (The disk and the segment can be very easily turned round together by putting any light weight on the disk and turning the segment alone, when the disk will turn with it.) Opposite the upper arrow on the disk may now be seen the velocity of flow.

4. To find the head required to produce a given velocity or discharge: (a) Set the diameter on the disk to the discharge, or the upper arrow on the disk to the velocity; (b) Bring the radial edge of the segment to the diameter on the scale corresponding to the selected value of N; then (c), below the length of pipe on the disk, find the required head of water on the segment.

A great advantage of the computer is that both the velocity of flow and the discharge are in every case seen simultaneously, one operation always giving these two results, so that if the velocity is too great, another and more suitable diameter can be at once selected by merely turning the velocity arrow to a more convenient rate of flow, while the resulting difference of head is at once seen opposite the length of pipe.

By the use of the scale N = 0.015 the computer may be used for circular sewers, conduits, etc., whose surfaces exposed to the flow of water are of second-class brickwork. If they run half full, the velocity will be the same as when running full but the discharge will be only half of that given by the computer.

The range of the computer is as follows:

| | | |
|---|---|---|
| Diameters | 1 in. to | 10 ft. |
| Heads of water | 1 ft. " | 1,000 " |
| Lengths of pipe | 10 " " | 10,000 " |
| Discharges | 1 cu. ft. per min. to | 10,000 |

The computer may also be used for certain classes of open channels if, in place of the diameter in inches, the corresponding hydraulic mean depth in feet is used, which is obtained by dividing the diameter by 48. The different values of N will then apply as follows:

N = 0.011 for channels lined with cement mortar and in good condition.

N = 0.013 for channels of ashlar and well-laid brickwork, plaster and planed wood in imperfect or inferior condition.

N = 0.015 for second-class or rough-faced brickwork or well-dressed stonework.

For flumes of unplaned timber when perfectly continuous on the inside, a mean value between N = 0.011 and N = 0.013 may be used.

To find the equivalent diameter of an open channel proceed thus: Suppose an open brick channel 5 ft. wide, with vertical sides, having 3 ft. of water in it. The area of the cross-section is 15 sq. ft. and the wetted perimeter 11 ft. Therefore the hydraulic mean depth $= \frac{15}{11} = 1.364$, which multiplied by 48 gives the diameter in inches of an equivalent pipe, namely, 65½ ins. If the radial edge of the segment is now brought to this diameter on scale N = 0.015, the velocity and the discharge of this channel may be at once found for any slope in precisely the same manner as for a 65½-in. pipe. A table of hydraulic mean depths corresponding to all diameters up to 10 ft. is provided with each computer.

The values of N and other data used in the above are taken from the late P. J. Flynn's excellent work on "Irrigation Canals." Further information may be obtained by addressing Mr. Wm. Cox, Savings Bank Building, Stapleton, N. Y.

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The Pennsylvania Steam, Heat, Light & Power Co. has obtained an ordinance enabling it to lay conduits for distributing steam in Philadelphia, in the territory bounded by Girard Ave. and South St. and the two rivers. This territory includes the heart of the city, and the only opposition came from the electric light companies. There is as yet no published detail of the plans of the new corporation.

## THE ROEBLING WIRE AND CONCRETE CONSTRUCTION FOR FLOORS AND WALLS.

The rapid and widespread development of the construction of large office buildings within the past few years has led to the design of various types of floor construction, in which a combination of lightness, strength, fireproofing and economy are aimed at. These types may be divided into two classes: First, the well-known hollow firebrick arch construction; second, a concrete arch strengthened by metal in some form or other. The accompanying cut represents a floor construction of the latter class, which was tested this week in the new office building at the corner of Broome St. and Broadway, New York city, and has already been used in large buildings in Boston, Pittsburg and other cities. Mr. William Orr, Superintendent of the Wire Cloth Mills at Trenton, N. J., was the original inventor of this system of fireproofing, and it is now being introduced by the New Jersey Wire Cloth Co., which is a department of the John A. Roebling's Sons Co., of Trenton, N. J., and 117 Liberty St., New York city. The New York business will be transacted through the latter office.

The Roebling floor system, which is clearly shown in Fig. 1, consists essentially of an arch of woven wire netting springing from the lower flanges of the floor beams and covered with a bed of concrete which is leveled up with the upper flanges of the beams. The netting is strengthened by iron rods at intervals of about 9 ins. each way, the wires being woven around the rods so as to form one sheet of netting. In the building above referred to the I-beams for the floors are 5 ft. apart, and the test arches have a rise of about 7½ ins. at the center. Two kinds of concrete were used. One was composed of 1 part of Dyckerhoff cement, 3 parts of sand and 6 parts of cinders, and the other of cement, sand and small broken stone in similar proportions. The depth of concrete was about 3 ins. at the crown of the arch. The cinder concrete weighs 35 lbs. per sq. ft., and floors constructed with it are guaranteed to stand safely a load of 600 lbs. per sq. ft. The stone concrete weighs 60 lbs. per sq. ft. and floors built with it have a guaranteed strength of 1,200 lbs. per sq. ft. The arches were built July 2, and the test loading was applied July 15. In the first test a board 12 ins. wide and 6 ft. long was laid on a thin bed of sand along the crown of the cinder concrete arch, and upon this were piled bricks in two rows of 20, the number of courses being 23, or 920 bricks in all. The bricks were regular building brick, 8 × 3½ × 2¼ ins., making nearly 36 cu. ft., and giving a load estimated at 700 lbs. per sq. ft. In the second test four rows of 14 brick each were laid across the stone-concrete arch, extending nearly to the floor beams, and resting directly upon a thin layer of sand. The brick were built up to a height of about 11 ft. to give the guaranteed loading of 1,200 lbs. per sq. ft. In both cases the brick were laid without bonding, so as to prevent any arch action due to bonding from relieving the test arch of any of the load. No measurements of deflection were made, the loads being simply working loads, but there were no signs of distress or failure.

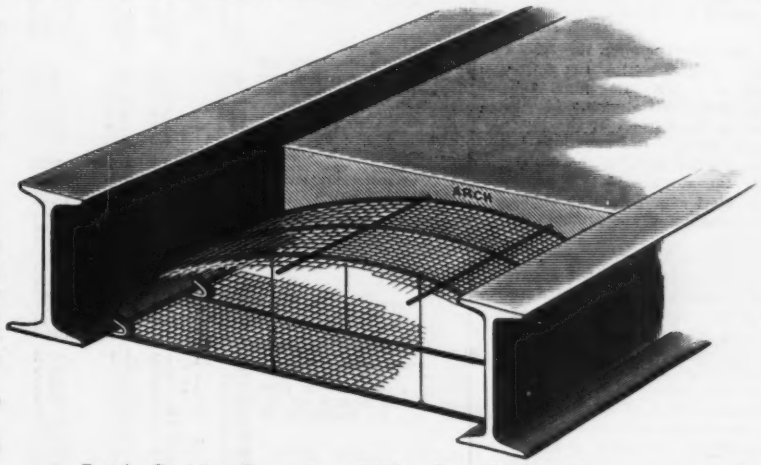



Fig. 1. Roebling Concrete and Wire Floor Construction.

At the Hotel Savoy, Boston, Mass., an arch of this construction was built between 15-in. I-beams 4 ft. 6 ins. apart, the thickness of the concrete being 1½ ins. at the crown. After standing nine days, a brick pier 3 ft. × 3 ft. 6 ins. was built on the arch to a height of 9 ft. 6 ins., giving a load equivalent to 1,080 lbs. per sq. ft. A second test, to determine the strength of the netting, was made by filling a box with sand until the load equaled 320 lbs. per sq. ft., when the test was discontinued, as the inspector of buildings expressed himself satisfied with the results. A drop test was then made by dropping a 46-lb. shot through an air-shaft opening to an intact floor 43 ft. below, striking directly on the crown of the unprotected arch, where the concrete was only 2½ ins. thick. The shot was embedded in the concrete to one-third of its diameter, and a corresponding protuberance appeared on the under side of the arch, but there was no crack or rupture. As a fourth test a mass of concrete weighing about 400 or 450 lbs. was dropped from a height of 11 ft. upon the concrete arch without cracking the arch.

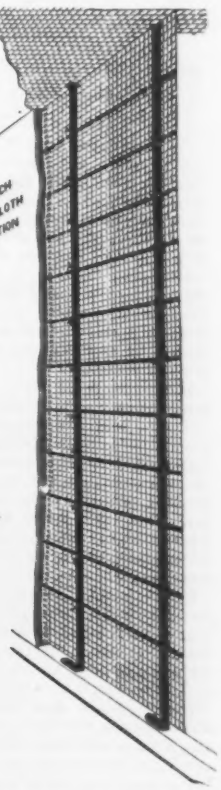



Fig. 2. Roebling Concrete and Wire Partition.

The ceiling in the Roebling construction may be arched, with plastering on the under side of the wire netting, or it may be flat, the plastering then being applied to a horizontal sheet of netting attached to the bottom flanges of the floor beams and to vertical wires hung from the wire arch. The same system of construction may also be applied to partitions, the netting being attached to studding of rods or channel irons, as shown in Fig. 2. Among the advantages claimed for this system are the following:

1, Saving in steel on account of the light dead load of the floors and partitions; 2, greater strength and stiffness on account of the homogeneous character of the construction, the floors acting as binding and bracing members to the ironwork; 3, safety, the floors being constructed on the arch principle, the strength of the concrete and iron is fully utilized, while the wire netting or centering, which by itself is capable of sustaining a load of over 300 lbs. per sq. ft., would protect any weak point that might exist in the floor owing to possible de-

fective mixing of the concrete; 4, permanence, this claim being based on the fact that the combination of concrete and iron in floor construction has been in use in France since the seventeenth century, and has proved its utility and fireproof property; 5, economy, not only by reason of the saving in steel in the structural work, but also by reason of the facts that the wire centering is cut to the required dimensions at the factory, ready for erection, and that the concrete can be mixed on the ground or in the basement and hoisted to the various floors, thus avoiding obstructing or interfering with the work of other workmen. In this respect it is claimed that the actual cost of this system is less by 10 to 20% than any other that has thus far had the approval of the Building Department of this city.

## DISTRIBUTION OF MOISTURE IN STEAM FLOWING IN A HORIZONTAL PIPE.*

By D. S. Jacobus, M. Am. Soc. M. E.

In a previous paper preliminary tests were presented which were made in connection with an investigation undertaken for the Babcock & Wilcox Co. by Prof. Denton.** In this paper it was demonstrated that various calorimeter nozzles, such as are now used in practice, do not give an average sample of the steam flowing through the steam main. It was also stated that tests were in progress to determine the efficiency of a nozzle devised by Prof. Denton, which consists of a ½-in. tube open at the end, passing through a stuffing-box, and so arranged that it may be moved to any position across the pipe under a full head of steam.

The tests made with the tube passing through a stuffing-box indicated that a greater part of the moisture was near the bottom of a horizontal pipe, and that it probably ran along in a small stream. If this was true, then an opening in the bottom of the pipe, so arranged that the water could run freely into it, would glean off all, or the greater part, of the moisture. The tests which are the subject of this paper were made to determine to what extent such an action takes place, and are a continuation of the preliminary investigation above referred to.

It was found that after steam had passed through 8 ft. of horizontal 3-in. pipe, 95% of the entrained moisture, or over, could be drawn from a ½-in. pipe leading from the bottom of the 3-in. pipe, for quantities of moisture as high as 8%, and velocities as high as 25 ft. per second.

The moisture was thoroughly mingled with the steam before entering the 3-in. pipe. The apparatus was so arranged that the greater part of the moisture was initially near the top of the pipe, so that it had to fall through the steam during the time taken to travel over the space of 8 ft. The theoretical time required for a body falling freely in space is about ⅛ second. Hence, the maximum initial horizontal velocity that such a body could have and reach the bottom in a horizontal space of 8 ft. would be 64 ft. per sec.

It appears from the experiments, therefore, that for the particular set of conditions which existed, 95% of the moisture can be gleaned from the bottom of a pipe if the velocity of the steam is three-eighths of that corresponding to the theoretical velocity already mentioned. For a velocity of 20 ft. per sec., or about one-third the theoretical velocity, 98% of the moisture was drawn from the bottom of the pipe for quantities of moisture as high as 10%. For a velocity of 43 ft. per sec., or seven-tenths of the theoretical velocity, about 60% of the total moisture was drawn from the bottom of the pipe, and at one-half of the theoretical velo ity about 90% was drawn out. It cannot be said that these ratios will apply to all cases, and for this reason additional tests are to be made to determine the effect of increasing the length of the horizontal pipe.

A special series of experiments was made, in which a horizontal plate was placed about ⅝ in. above the bottom of the 3-in. pipe, and over the ½-in. pipe leading to the calorimeter. The plate was arranged so that all the moisture which collected under it would run into the calorimeter. The object of introducing the plate was to collect all the water which was near the bottom of the pipe, so as to determine to what extent a nozzle, simply tapped into the bottom of the pipe, would remove such moisture. The results of corresponding tests, with and without the plate over the calorimeter nozzle, are about the same, which indicate that a nozzle connected so that its inner end is flush, or slightly below the bottom of the pipe, will remove practically all the moisture which flows near the bottom of the pipe.

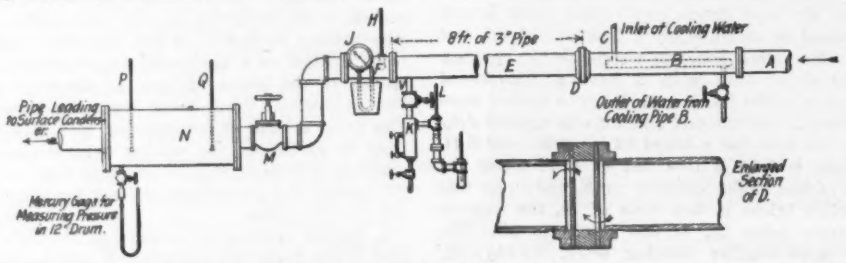
The results of the experiments on the 3-in. pipe are given in detail in the accompanying table.

Percentage of Total Moisture Entering a 3-in. Horizontal Steam Pipe that is Removed by a ½-in. Drip Pipe.

The moisture in each case was either thoroughly mingled with the steam or the greater part of it was near the top of the 3-in. pipe at a point 8 ft. distance from the ½-in. drip pipe. Much of the moisture had, therefore, to fall through a distance nearly equal to the diameter of the 3-in. pipe before it was drawn out at the ½-in. drip pipe.

| Condition under which the tests were made. | Velocity of steam in 3-in. pipe, ft. per sec. | Percentage of priming in steam passing through 3-in. pipe. Before reaching drip pipe. | Percentage of priming in steam passing through 3-in. pipe. After passing drip pipe.* | Percentage of total moisture removed by the ½-in. drip pipe leading to the Barrus calorimeter. |
|---|---|---|---|---|
| 1st series of tests. Moisture produced by the cooling pipe marked B. No mixing device at D. | 65.1 | 3.9 | 2.2 | 45.6 |
| | 64.7 | 1.9 | 0.9 | 55.7 |
| | 63.3 | 1.5 | 0.4 | 71.7 |
| | 52.3 | 1.6 | 0.3 | 84.4 |
| | 52.2 | 4.2 | 1.6 | 62.8 |
| | 41.9 | 3.3 | 0.3 | 91.5 |
| 2d series of tests, in which a mixing device was placed at D to thoroughly mingle the steam and water. | 38.1 | 4.8 | 0.6 | 88.6 |
| | 38.1 | 2.6 | 0.5 | 82.8 |
| | 38.1 | 2.4 | 0.4 | 85.6 |
| | 38.1 | 0.3 | 0.0 | 100.0 |
| | 38.0 | 1.6 | 0.2 | 89.0 |
| | 38.0 | 0.4 | —0.1 | 100.0 |
| | 24.9 | 4.8 | 0.1 | 98.7 |
| | 24.8 | 3.1 | —0.1 | 100.0 |
| | 24.5 | 8.2 | 0.5 | 95.0 |
| | 19.2 | 8.8 | 0.5 | 95.5 |
| | 16.0 | 6.6 | 0.1 | 98.1 |
| | 16.0 | 6.6 | 0.1 | 98.1 |
| | 15.9 | 1.0 | —0.1 | 100.0 |
| | 15.6 | 5.4 | —0.1 | 100.0 |
| 3d series of tests, in which the steam and entrained misture was supplied through a vertical 3-in. pipe and flowed through an elbow into the horizontal 3-in. pipe. | 43.1 | 3.5 | 1.2 | 67.3 |
| | 42.7 | 2.3 | 0.7 | 68.8 |
| | 35.9 | 1.3 | 0.2 | 85.2 |
| | 35.8 | 3.4 | 0.7 | 80.8 |
| | 31.1 | 3.5 | 0.3 | 91.7 |
| | 31.1 | 2.1 | 0.1 | 95.0 |
| | 20.9 | 12.1 | 0.5 | 96.8 |
| | 20.6 | 7.8 | 0.0 | 100.0 |
| | 20.5 | 2.5 | —0.1 | 100.0 |
| | 20.2 | 3.8 | 0.1 | 97.1 |
| | 15.8 | 5.6 | —0.2 | 100.0 |
| | 15.4 | 8.7 | —0.2 | 100.0 |
| Special tests in 3d series, in which a plate was placed over the drip-pipe leading to the calorimeter, so as to collect all moisture that was near the bottom of the pipe | 42.1 | 3.5 | 1.1 | 66.6 |
| | 42.1 | 2.2 | 1.2 | 49.4 |
| | 41.9 | 2.4 | 1.1 | 57.4 |
| | 38.1 | 2.4 | 0.6 | 77.8 |
| | 34.3 | 2.5 | 0.1 | 96.7 |
| | 33.1 | 3.4 | 0.0 | 100.0 |
| | 26.9 | 7.3 | —0.1 | 100.0 |
| | 26.8 | 4.8 | 0.0 | 100.0 |
| | 20.5 | 4.3 | —0.1 | 100.0 |
| | 20.2 | 13.1 | 0.4 | 97.4 |
| | 20.2 | 4.9 | 0.0 | 100.0 |

* The percentages of priming given in this column are calculated from the superheating in the 12-in. drum, and are correct to within about 1-10%. The minus values are either accidental discrepancies or they are caused by the fact that the steam was initially superheated, and tended to retain the property of producing a slightly higher "normal reading" than that given by the theoretical formula.




APPARATUS FOR DETERMINING THE DISTRIBUTION OF MOISTURE IN STEAM FLOWING THROUGH A HORIZONTAL PIPE.

In Prof. Denton's experiments a single calorimeter was at first attached to the bottom of a horizontal 12-in. pipe by means of a nozzle, which could be raised and lowered so as to draw steam from various sections of the pipe, as has been already described. It was found that the weight of moisture ranged between about 5 and 50% of the weight of steam passing through the calorimeter when the nozzle was lowered so as to be near the bottom of the pipe; whereas, when the nozzle was raised so as to be about 1¼ ins. above the bottom of the pipe, the steam which passed through the calorimeter was practically dry. In these tests the steam passed from the boiler through about 10 ft. of horizontal 12-in. pipe to an elbow, and thence through a second horizontal 12-in. pipe. The calorimeter was attached to the second horizontal pipe about 6 ft. from the elbow. The velocity of the steam was about 17 ft. per second, representing about 500 HP.

After making the tests with a single calorimeter, a second series of tests was made with two calorimeters, to determine if the moisture was all at the bottom, or if it was also creeping along the sides of the pipe. To make these tests, the second calorimeter was placed at the same cross-section of the pipe as the first, but it was moved to one side, so as to be 4 ins. from the calorimeter attached directly to the bottom of the pipe. It was found that when both nozzles were set so that the ends were flush with the inner surface of the pipe, the calorimeter at the bottom of the pipe indicated excessive moisture, whereas the calorimeter 4 ins. from it toward the side of the pipe showed practically dry steam. This indicated that all the moisture was at the bottom of the pipe.

The general arrangement of apparatus for conducting the tests on the 3-in. horizontal pipe is represented in the accompanying cut.

Superheated steam entered at A, and passed through a 3-in. pipe surrounding a cooling pipe, B. The cooling water entered at C and passed off at G. After passing the cooling pipe, the steam passed through a device at D, which thoroughly mixed the steam with the water. This consisted of two plates placed about 1 in. apart, in which were two holes about ⅞ in. in diameter. The hole in the first plate encountered by the steam was at the bottom of the pipe, so that all moisture in the steam would be drawn from the bottom of the pipe. The steam and moisture then passed upward between the plates and out of the hole in the second plate. The hole in the second plate was placed near the top, so as to introduce the steam and moisture near the top of the 3-in. pipe, E. The calorimeter was attached at V. K is the separator portion of the calorimeter, and L the heat gage. The temperature and pressure of the steam were measured on leaving the pipe E by means of the thermometer, H, and the pressure gage, J. The thermometer, H, was placed in a mercury well having an enlargement at its lower end and a thin neck. The steam was throttled by means of the valve, M, from a pressure of about 80 lbs. above the atmosphere in the pipe, E, to about the pressure of the atmosphere in the 12-in. drum, N. The temperature of the steam after throttling was measured by a thermometer, Q, placed in a mercury well, and by a thermometer, P, which came in direct contact with the steam. The pressure in the drum, N, was measured by means of a mercury gage. The steam flowing into the drum, N, was led to a surface condenser, and finally weighed.

The amount of moisture in the steam passing through the valve, M, was indicated by the amount of superheating in the 12-in. drum, N. This moisture, added to the moisture in the steam entering the Barrus calorimeter, gave the total moisture contained in the steam passing through the 3-in. pipe. Corrections, determined directly by experiment, were made for all radiation. The factor of 0.48, for the specific heat of steam, was employed in calculating the percentage of moisture, and special experiments were made to show how nearly this method would agree, in the case of the 12-in. drum, with the experimental normal reading for dry steam. These experiments, from the nature of the apparatus, could be made only with steam just at the point of superheating, or with slightly superheated steam, and the results obtained were the same as in similar tests made on a Barrus calorimeter, and given in the paper on "Errors of Calorimeters."

It was found that the experimental normal reading for steam in a maximum state of dryness, when corrections were made for all radiation, and the temperatures were corrected so as to correspond to those registered by an air thermometer, was 3° higher than the theoretical normal reading. The initial pressure in all the tests was about 80 lbs. per sq. in. above the atmosphere.

With steam that was slowly condensing, the tests made in connection with the "Errors of Calorimeters" showed that the normal reading with a Barrus calorimeter was 3° lower than for steam of the maximum dryness, so that if this same difference applies to the 12-in. drum, the experimental normal reading for steam which is slowly condensing, and therefore contains the maximum amount of moisture, would be the same as the theoretical normal reading, employing a factor of 0.48 for the specific heat of steam.

Three series of tests were made. In the first there was no mixing device placed at D. In these it was

* A paper read at the Detroit meeting of the American Society of Mechanical Engineers.

** "Results of Measurements to Test the Accuracy of Small Throttling Calorimeters," "Transactions," Vol. XVI., p. 448, Eng. News, Dec. 13, 1894.

found that the thermometer, H, would indicate superheating with considerable moisture entering the calorimeter nozzle, V. The second series of tests were made after adding the mixing device, D. In the third series of tests the 3-in. pipe containing the cooling pipe, B, was lowered, together with the mixing device, D, and the steam was made to pass through an S-shaped connection of 3-in. pipe into the pipe E. This caused the steam which was admitted to E to pass upward through a vertical pipe, then turn through an elbow into the pipe E. The object of the latter arrangement was to make the mixture of steam and water enter the pipe E at the same velocity at which it flowed through the pipe E. When the steam and moisture entered the 3-in. pipe directly from a ⅜-in. hole in the mixing device, D, it was initially at a much greater velocity than the average velocity in the pipe E, but it was considered best to make tests in this way, so as to have one set of tests in which the conditions were as severe as possible.

## THE JEROME PARK RESERVOIR, NEW YORK.

Among the vast undertakings laid out by the Croton Aqueduct Commission in 1883 and 1884 was a great distributing reservoir north of the Harlem

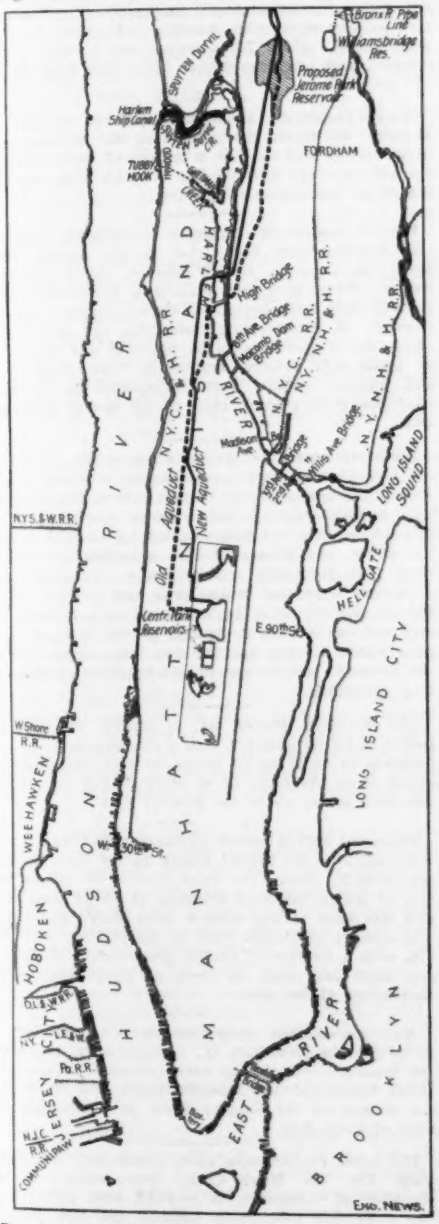



Fig. 1. Location of the Jerome Park Reservoir in Reference to Lower New York.

duct. For ten years no steps were taken to build this reservoir, but on June 8, 1893, the commissioners formally requested the Department of Public Works to make surveys of the land necessary for this structure. Between that date and July 10, when bids for construction were received, all necessary surveys, plans and specifications were prepared, and commissioners were appointed to appraise the value of the land taken. The detailed bids received on the above date, together with the quantities involved, are given under Contract Prices in our Construction News Supplement to this issue.

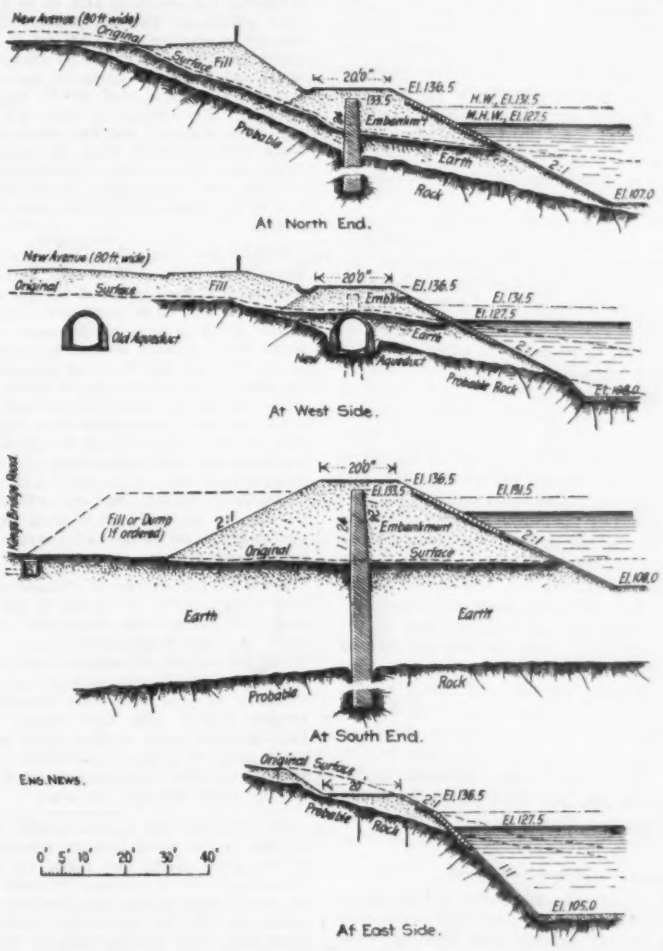



FIG. 3. TYPICAL SECTIONS OF JEROME PARK RESERVOIR EMBANKMENTS.

The capacity of the new reservoir will be about 2,000,000,000 gallons, which is one-third larger than was originally proposed, owing to the decision to remove what would otherwise have been two islands and also a high point of land. The capacity of the existing Central Park reservoirs is about 1,000,000,000 gallons. The average daily consumption of water by New York city in 1894 was 183,000,000 gallons. Doubtless the consumption will reach 200,000,000 gallons before the new reservoir is completed, in which case it will contain a ten-days' supply. On the same basis the present distributing reservoirs would give a five-days' supply, but in each case it is assumed that the reservoirs would be emptied. This could not be done, according to the recent report of the Aqueduct Commissioners, without entailing hardship through a diminution of pressure. Mr. A. Fteley, M. Am. Soc. C. E., Chief Engineer of the Croton Aqueduct, states that only half of the whole distributing reservoir supply should be depended on, or 7½ days' service from both, and five from the new reservoir. But in case of accident to the new aqueduct the old one can be relied upon for a daily supply of at least 75,000,000 gallons, while the old one can be put out of use at any time for years to come without inconvenience.

The reservoir will cover some 300 acres of land. Its location in relation to lower New York is shown by the accompanying map, Fig. 1, and its shape and immediate surroundings by Fig. 2. The reservoir will be in excavation and embankment, the types of construction being shown by the sections, Fig. 3. The maximum height of embankment will be 36 ft.

The old aqueduct passes through the reservoir site, and the new aqueduct at an average depth of 115 ft. beneath it, the latter being under pressure here, and communicating with the surface by Shaft 21. To feed the reservoir, a new section of the new aqueduct will be built, for the most part along the old aqueduct, the two to be enclosed in a masonry wall dividing the reservoir into two sections, as shown on the plan, Fig. 2. The new piece of aque-

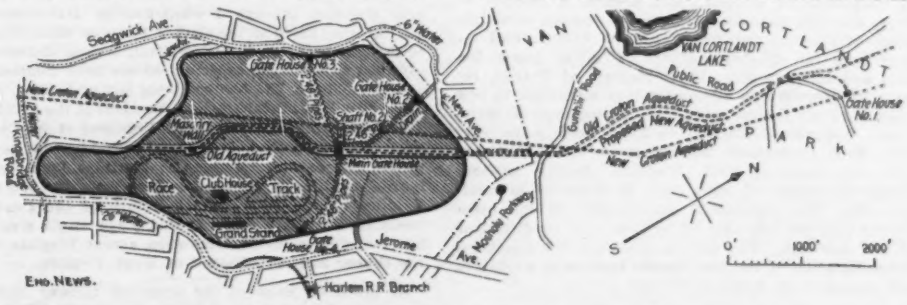



FIG. 2. JEROME PARK RESERVOIR AND LOCATION OF OLD AND NEW AQUEDUCTS.

duct will be of horseshoe shape, 13.53 ft. high and 11.4 ft. wide. Several gate houses will be built. The first one will be located at the point where the new section of aqueduct branches off. The main gate house will allow the old aqueduct either to discharge into the reservoir or carry water directly to the city; it also establishes a connection between the old and new aqueducts, permits the new aqueduct to discharge into either section of the reservoir, takes water after having circulated through the reservoir back into the new aqueduct through Shaft 21, and by means of pipes leading to three other gate houses enables the supply to be kept up whether one or both sections of the reservoir are empty.

A total of 18 bids were received for constructing the reservoir, ranging in totals from $5,297,370, by Mr. John J. O'Brien, to $13,368,200, by Mr. B. F. Coleman, both of New York city. The engineer's estimate was $5,882,690, and 6 of the 18 bids were below this sum. At whatever price the contract is awarded, there must be added to it the cost of some 300 acres of city land, besides engineering and supervision. The main quantities involved in construction are nearly 4,000,000 cu. yds. of earth and about 3,200,000 cu. yds. of rock excavation; 150,000 cu. yds. of concrete and 82,000 of brick and 113,000 cu. yds. of rubble masonry, and 250,000 sq. yds. of rubble masonry facework.

The prices named by the lowest bidder for the excavation were 30 cts. per cu. yd. for earth and 75 cts. for rock, against the engineer's estimate of 28 and 92 cts., respectively, for the bulk of this work. A number of the bids for earth excavation were below 30 cts., one being only 21 cts., but none of the bids on rock excavation were as low as that of the party who made the lowest bid on the whole work, the nearest being 80 cts. As stated above, the bids in detail are given elsewhere in this issue. We are indebted to Mr. Fteley and to Mr. Edw. L. Allen, Secretary of the Aqueduct Commission, for the list of bids. Most of the other information, including the illustrations, has been taken from the report of the Aqueduct Commission for the years 1887 to 1895, which was reviewed in our issue of July 11.

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Dynamite guns might endanger costly and elaborate systems of marine defense by exploding submarine mines, according to the opinion now held by some naval officers after studying the lessons taught at Port Arthur and Wei-hai-wei. The depth of water in harbors is usually not great, and the Japanese successfully cleared the way for their warships by exploding hidden mines by firing torpedoes and heavy charges of powder in the channel. The effect of a misdirected shot from a dynamite gun, in a harbor similarly protected, would be likely to have a similar result, and thus damage or nullify the very means adopted to defend the harbor.

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The fourth international congress, to formulate uniform methods of testing materials of construction, will be held at Zurich, Switzerland, on Sept. 9, 10 and 11, under the presidency of Prof. L. de Tetmajer. Cards of membership costing $3.20, or 16 francs, can be secured by engineers after arrival, and give the holder a right to all publications, excursions on the Uto and Dolder, entry to the hall of meeting and the adjoining park and to the final banquet. A number of papers will be presented, and among the authors and subjects announced are the following: Dr. Delbrueck, Counsellor of Commerce of Prussia, will present a memoir of Prof. Boehme, founder of the royal testing establishment of Prussia; Director Exner, of Vienna, will report upon the existing methods of testing paper, tissues and other fabrics; Prof. Steiner, of Prague, results of experiments upon cast iron subjected to low temperatures; Engineer-in-Chief Eckermann, of Hamburg, researches into the lack of solidity in cast iron; M. R. Dyckerhoff, the influence of sea water upon hydraulic mortars; Prof. Wedding, Berlin, uniform chemical analysis of iron; Prof. H. Kast, on lubricating oils. The permanent organization of the association and the adoption of by-laws will be discussed at the meeting. The society now has 173 members, including some of the best known engineers, educators and managers of works in Europe.

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The drainage system for New Orleans recommended by the Advisory Drainage Board was adopted by the city council on July 9 by a vote of 18 to 4. This scheme was outlined in Engineering News for May 30, 1895. The advisory board recommended that the commercial portion of the city be drained first, at an estimated cost of $1,310,000. The sum of $700,000 was set apart for a start on this work some time ago, it having been paid to the city by a street railway company for franchise privileges.

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A dredging contract amounting to $6,000,000 is reported to have been concluded between the Seattle South Canal Co., of Seattle, Wash., and the Bowers Dredging Co., which is said to be a Chicago company with offices at Tacoma, Wash. The contract calls for the excavation of 35,000,000 cu. yds. of earth, of which 9,000,000 yds. are to be dredged from the waterways and 26,000,000 from the three-mile canal which will cut through a bluff 200 ft. high and half a mile through. The excavating there will be done by sluicing. The company has five years in which to do the work, and expects to keep two large dredges busy on it for most of that time. The earth excavated will fill in 2,000 acres of tide flats. C. H. Prescott is President and S. W. Maxwell is Secretary of the dredging company.

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A 16-in. force main is to be laid across the Kennebec River from Bath to Woolwich, Me., and the contract has recently been awarded to Mr. Jos. G. Falcon, of Evanston, Ill. It is to replace a main recently put in which failed to meet requirements when tested. An extra heavy flexible Falcon ball joint will be placed every 50 ft. on the line, and the specifications require the pipe to stand a pressure of 150 lbs. when completed. About 40 Falcon joints will be used. Mr. Falcon informs us that where there is a rock-bottom, the pipe will be fastened every 50 ft. to bedrock by drilling holes into the rock and putting in two iron stanchions, one on each side of the pipe, and a strap connecting their tops. In soft material sufficient dredging will be done to take the strain from the joints. All connections will be made under water. Work is to be commenced at once.

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Work on the harbor of Philadelphia is progressing very satisfactorily, according to the report, just presented, of Major C. W. Raymond, Corps of Engineers, U. S. A., and Engineer-in-Charge. To July 1, 1895, 10,440,292 cu. yds. of material have been removed from Windmill and Smith's islands, and of this quantity 2,355,613 cu. yds. have been deposited and spread on League Island. The two islands first named have been dredged away so that there is now an average depth of 18 ft. of water over them. At the date given, $706,092 remained unexpended out of a total appropriation of $2,341,000 for this work.

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The drydock built at the League Island Navy Yard in 1891 is too small for the vessels now being built by the government, and plans are being prepared at Washington for a concrete drydock 700 ft. long over all, 80 ft. wide at the entrance and 30 ft. deep. The estimated cost is somewhere between $700,000 and $1,000,000. The wooden drydock built in 1891 is 530 ft. long, 52 ft. wide on the bottom, 84 ft. wide at the top and 27 ft. deep. It cost about $500,000. The authority to build the concrete dock and the money to pay for it are yet to be obtained from Congress.

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The Pennsylvania R. R. Co. is proposing to spend about $5,000,000 within the next year on its property, and has secured this money by a new London loan at 3½%. This money will be disposed of about as follows: For the bridge across the Delaware, at Philadelphia, $1,000,000; third and fourth track construction, grade crossing elimination, etc., on lines east of Pittsburg, $1,500,000; reconstruction of bridge at Cincinnati, $800,000; lowering grade on Cleveland & Marietta R. R., $250,000; abolishing grade-crossings in Columbus, O., $250,000; widening tunnels on Pittsburg, Cincinnati & St. Louis R. R., $200,000. About 1,500 iron and coal cars are also to be built.

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An important piece of new railway construction, recently noted in our Construction News columns, is the Chesapeake & Western R. R., projected to extend from Matthias Point, Va., on the Potomac River, in a westerly direction through Fredericksburg, Harrisonburg, and the coal fields of the Gauley basin in West Virginia to some point on the Ohio River, a total distance of over 300 miles. The construction has been commenced at Harrisonburg, Va., roadbed being laid with 80-lb. steel rails. Mr. J. W. Reinhart, late President of the Atchison, Topeka & Santa Fe R. R. Co., is President of the Chesapeake & Western Co. If this road should be built as projected, the eastern terminus at Matthias Point would be almost directly across the river from the southern terminus of the Pope's Creek branch of the Pennsylvania R. R., and a ferry at this place would give the latter system a direct connection across Virginia with the timber and coal district of West Virginia.

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Of the 6,000 miles of the projected railway line between St. Petersburg and Vladivostock, via the Trans-Siberian railway, 3,700 miles remain to be built. Of the Trans-Siberian railway proper only 750 miles are opened to traffic: the 500 miles between Chelabinsk and Omsk, and the 250 miles extending from Vladivostock west to Grafskaja. A new and longer route has been surveyed for the Lake Baikal section. The line originally adopted passed 3,000 ft. above the sea level and through a comparatively sterile region, not likely to attract emigration. The new line lies further to the south, passing by the rivers Dialda, Tschika, Chilka and Uda, and through a rich mining region.

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The Great Colombian Ry., which is to run from Girardot, on the Magdalena River, at Bogota, the capital city of Colombia, 93 miles, has already been commenced, and negotiations for the sale of bonds to complete the line are now being made with English capitalists. The cost of construction and equipment is estimated at $3,000,000. The President of the company is Mr. S. B. McConnico, 11 Pine St., New York, and the Secretary is Mr. E. S. Smith, of Philadelphia, Pa. The road was described in our issue of May 2.

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The International Railway Congress was given a dinner at the Crystal Palace, near London, on July 8 by the Railway Companies' Association, at which Lord Stalbridge, President of the London & North Western Ry., presided. Mr. Henry S. Haines, President of the American Railway Association, made a speech, in which he said it was a serious undertaking for the American delegates to forsake their duties so long, and would not have felt warranted in doing so but for the importance of the congress. The railway managers of Great Britain, he added, had made the name of British railways synonymous with safety of life and celerity of transit, and he hoped that many of the railway men present would visit America and inspect the railways there. About 750 persons were present at the banquet, and after the dinner there were fireworks in the grounds.

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A steel freight car has been built at the car shops at Minerva, O., under the patents of Mr. Willard Pennock, and is said to have a weight of 22,000 lbs. for a rated capacity of 60,000 lbs. The material was furnished by the Carnegie Steel Co.

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Heated cars for the transport of perishable goods in cold weather have been tried on the railway from Berlin to Coblentz and Wiesbaden during the last winter. These cars were built with double sides, and through this space heated air from a furnace was circulated. A thermometer seen from the outside enabled the temperature to be watched and regulated. In these cars flowers, vegetables, fruit, beer, wine and mineral waters were transported in excellent condition from Dec. 4, 1894, to the end of February, 1895.

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Elevators capable of lifting a locomotive and three cars are contemplated in connection with the depression of the tracks of the Philadelphia & Reading railway in Philadelphia. This subway would be on the line between the old Broad St. station and the Schuylkill River, and passes through a section of the city filled with industrial establishments. To serve these from the depressed tracks was the problem to be solved. By the plans finally agreed upon between the city and the railway company, grades of 5% will be used where feasible, and for two large establishments the elevators will be put in and operated by the railway company.

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The Northern Pacific Ry. is testing the tractive power of its locomotives with a dynamometer car, and proposes to make up its trains on a tonnage basis instead of on the basis of so many loaded cars, which has been in use up to the present time.

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Steam and sailing vessels aggregating 132,719 gross tons were built in the United States during the year ending June 30, 1895. The total number of vessels was 682, of which 283 were steamers of 75,728 gross tons, and 399 were sailing vessels, with 56,990 gross tons. The number of vessels built in the previous year was 776, with a tonnage of 121,547 gross tons. Of the vessels built last year 36 were of steel construction, measuring 47,696 tons.

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An international deep waterways convention is to be held in Cleveland, O., in September, to discuss the questions of a deep-water channel between the Great Lakes and the Atlantic Ocean, and of limiting the outflow of the Niagara River so as to raise the level of Lake Erie.

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The latest Pacific cable news comes from San Francisco, Cal. Mr. Hugh Craig, vice-president of the Chamber of Commerce, is credited with saying that the cable line connecting Canada and New Zealand will be built by British capitalists. As planned, the cable would be laid from Auckland, New Zealand, to Norfolk Island, 415 miles distant; then to Fiji, 1,002 miles; to Fanning Island, 1,715 miles, and finally to Vancouver, 3,242 miles. The total length of this cable would be 6,374 miles, and the estimated cost is $7,535,000. Other lines would be laid to connect it with Sidney, New South Wales, and other points in the Southern hemisphere. Mr. Craig mentions no names and goes into no detail as to date of construction, etc.

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## PERSONALS.

Mr. George Whaley has been elected Vice-President and General Manager of the Panama R. R.

Mr. Phineas C. Brintnall, railway contractor, died at Binghamton, N. Y., July 10, at the age of 66.

Messrs. F. J. Ehret, R. W. Young, and G. W. F. Randolph have been appointed Water-Works Commissioners of Salem, W. Va.

Mr. W. I. Midler, Assistant General Ticket Agent, has been appointed General Ticket Agent of the Pullman Palace Car Co., vice Mr. Geo. M. Gray, deceased.

Mr. Geo. A. Atherton, County Surveyor, Stockton, Cal., has been appointed Chief Engineer of the Alameda & San Joaquin R. R. Co., which proposes to build a railway from Corral Hollow to Stockton.

Mr. Joseph B. Stearns, inventor of the Duplex system of telegraphy, died at Camden, Me., and not Camden, N. J., as stated in our issue of July 11. He had been a prominent figure in the public improvements of that town for several years.

Mr. A. R. Shindler, of Tucson, Ariz., has resigned his position as Resident Engineer of the Southern Pacific Ry., to accept that of Assistant Chief Engineer of the San Francisco & San Joaquin Valley Ry., with offices at San Francisco, Cal.

Mr. D. T. Forbes has been appointed General Superintendent of the New York, Texas & Mexican and Gulf, Western Texas & Pacific railways, succeeding Mr. W. S. Hoskins, who has resigned. The roads form part of the Atlantic System of the Southern Pacific Ry., and the offices are at Victoria, Tex.

Mr. J. J. R. Croes, M. Am. Soc. C. E., has been appointed consulting engineer to the Bronx Valley Sewer and Highway Commission, created by the laws of 1895, to inquire into the expediency of constructing a sewer and highway through the counties of New York and Westchester along the Bronx River.

Mr. George S. Walsh, a graduate of Rensselaer Polytechnic Institute, in the class of 1894, has accepted a position on the construction of the Santa Ana Railway in San Salvador. He sailed from New York on July 10, and his address will be in care of Mr. A. J. Scherzer, Ferrocarril de Santa Ana, Sonsonate, Salvador, Central America.

Mr. Everett A. Stevens, Member of the Massachusetts Board of Railroad Commissioners, died July 13 at Norridgewock, Me. He was born in Madison, Me., 52 years ago, and became an engineman on the Fitchburg R. R. In 1883 he was appointed a State Railroad Commissioner by Governor Butler, and had been reappointed by succeeding governors up to this time.

Mr. Louis Edward Asser, engineer, formerly Chief of Track and Works of the Dutch Railway, of Holland, who was Secretary of the Sixth International Congress on Internal Navigation, held at The Hague last year, died June 30. The engineers who attended that Congress will recall his ability as a secretary and his consideration for the members and visitors who were at The Hague.

Mr. A. A. Jackson, formerly General Superintendent of the New York & New England R. R., died at Norwood, Mass., July 8. He was born at Rockland, Pa., in 1831, and after a varied business and railway experience, became Superintendent of the Allegheny Valley R. R., in 1875, which position he held until 1887, when he was appointed General Superintendent of the New York & New England R. R.

Mr. John Lundie, M. Am. Soc. C. E., the Chicago representative of the King Bridge Co., is the author of a little book entitled "Sam's Dilemma; A Parable Bearing on the Silver Question and its Solution," recently published by the Star Publishing Co., Chicago. The book is intended to make clear the principles involved in the present currency agitation to those who are unfamiliar with the general principles of political economy.

Sir Archibald Geikie, F. R. S., the eminent Scotch geologist, is said to have been invited by the trustees of Johns Hopkins University, Baltimore, Md., to be the Williams lecturer on geology. He was born in Edinburgh in 1835, and became Professor of Geology and Mineralogy at the University of Edinburgh, which position he resigned in 1882. In 1881 he was appointed Director-General of the Geological Survey of the United Kingdom, and Director of the Museum of Practical Geology in London.

Mr. Samuel G. Artingstall, M. Am. Soc. C. E., has resigned his position as City Engineer of Chicago, owing to difficulties between himself and Commissioner of Public Works Kent. Rumor has it that the final breach arose from the refusal of Mr. Artingstall to appoint an assistant engineer whom he deemed incompetent to perform the duties to which Commissioner Kent wished him to be assigned. Mr. John Ericsson, Assistant City Engineer, will fill Mr. Artingstall's position, for the present at least.

Mr. Edwin R. Reynolds, M. Am. Soc. M. E., and Mr. Don J. Whittemore, Past Pres. Am. Soc. C. E., both of Milwaukee, Wis., have had the honorary degree of LL. D. conferred upon them by the University of Wisconsin, on account of their services in the interest of engineering and the industrial arts. Mr. Reynolds is the designer and builder of the Reynolds-Corliss engine, and Vice-President and General Superintendent of the E. P. Allis Co. Mr. Whittemore is Chief Engineer of the Chicago, Milwaukee & St. Paul Ry.

Mr. A. N. Towne, Second Vice-President and General Manager of the Southern Pacific Ry., died in San Francisco, Cal., July 16, at the age of 69. He began his railway experience as a brakeman on the Chicago, Burlington & Quincy R. R. In 1869 he went to the Pacific coast as General Superintendent of the Central Pacific R. R., and he remained with that company and its lessor, the Southern Pacific Ry., till he died. As extensions were built by the Southern Pacific Co. his authority was extended, until he had charge of nearly 5,000 miles of railway. He was a student of all questions appertaining to railways, and of commercial and economic problems affecting the state of California and its people. He was an author and writer of treatises on railway and other questions, and was closely identified with the industrial development of California.

## ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERING ASSOCIATION OF THE SOUTH.
Aug. 8. Secy., H. D. Ruhm, Nashville, Tenn.
AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.
NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 11 to 13. At Burlington, Vt. Secy., John C. Whitney, Newton, Mass.
NATIONAL IRRIGATION CONGRESS.
Sept. 16 to 19. At Albuquerque, N. Mex. Secy., Fred L. Alles, Los Angeles, Cal.
NEW ENGLAND ROADMASTERS' ASSOCIATION.
Sept. 18, 19. Secy., M. C. Hamilton, Hartford, Conn.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 8. At Atlanta, Ga. Secy., R. W. Raymond, New York, N. Y.
ROADMASTERS' ASSOCIATION OF AMERICA.
Oct. 8. At St. Louis, Mo. Secy., W. W. Sharpe, Waycross, Ga.
AMERICAN INT. ASSOC. OF RY. SUPTS. OF BRIDGES AND BUILDINGS.
Oct. 15. At New Orleans, La. Secy., S. F. Patterson, Concord & Montreal R. R.; Concord, N. H.
AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 15. At Montreal, Que. Pres., Joel Hurt, Atlanta, Ga.

ROCHESTER ACADEMY OF SCIENCE.—The engineering section made a trip to Syracuse, N. Y., on July 10, and visited the new reservoir, and the Empire Portland Cement Works at Warner's, N. Y., near Syracuse.

THE CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the meeting on July 9 the following resolution was passed: Resolved: that the Civil Engineers' Club of Cleveland learns with sorrow of the death of A. M. Wellington, one of its original members. He was among those who took great interest in its formation, and was instrumental in placing it upon its present footing. He was its first representative upon the Board of Managers of Engineering Societies, and was active in the affairs of the Association as well as in those of the club. In his death the profession of civil engineering sustains a great loss, and we shall miss his substantial contributions to its literature. We desire to express our deep regret at his untimely decease, and to convey to his family our sincere sympathy.

Mr. Wm. H. Searles then read a paper on "The Deflections and Stresses of a Flexible Ring Under Load."

F. A. Coburn, Secy.

## CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

| Bids to be opened. | Work. | Place. | See Eng. News. |
|---|---|---|---|
| July 19. | Water and light bonds, Windom, Minn. | | June 27 |
| July 19. | Flagging, etc., Elizabeth, N. J. | | July 4 |
| July 19. | Street lighting, Marcus Hook, Pa. | | July 4 |
| July 19. | School building, Marlette, Mich. | | July 4 |
| July 19. | Parkway, Boston, Mass. | | July 11 |
| July 19. | Sewers, Brooklyn, N. Y. | | July 11 |
| July 19. | Street cleaning and sprinkling, Buffalo. | | July 11 |
| July 19. | Sewers, Camden, N. J. | | July 11 |
| July 19. | School building, Kingston, Pa. | | July 11 |
| July 19. | Bridges (8), Wayne, Neb. | | July 11 |
| July 19. | Jail, Hamilton, Ont. | | July 11 |
| July 19. | Storm sewers, Baltimore, Md. | | July 18 |
| July 20. | Water-works franchise, Perth, Ont. | | June 20 |
| July 20. | School buildings (2), Cleveland, O. | | June 27 |
| July 20. | Water-works system, Union, Mo. | | June 27 |
| July 20. | Water bonds, New Britain, Conn. | | July 11 |
| July 20. | Intake tunnel, Buffalo, N. Y. | | July 11 |
| July 20. | Building work, Geneseo, N. Y. | | July 11 |
| July 20. | Asphalt paving, Saginaw, Mich. | | July 11 |
| July 20. | Brick paving, Saginaw, Mich. | | July 11 |
| July 20. | Brick paving, East St. Louis, Ill. | | July 11 |
| July 20. | Electric lighting, Lowell, Mich. | | July 18 |
| July 20. | Plans for school building, Toledo, O. | | July 18 |
| July 20. | Fire engine house, Washington, D. C. | | July 18 |
| July 20. | Sewer bonds ($150,000), Ithaca, N. Y. | | July 18 |
| July 20. | Sewers, Wheeling, W. Va. | | July 18 |
| July 20. | Brick paving, Wheeling, W. Va. | | July 18 |
| July 22. | Electric light plant, Washington, D. C. | | July 4 |
| July 22. | Bridge work, Salem, Mass. | | July 11 |
| July 22. | Granolithic pavement, Baltimore, Md. | | July 11 |
| July 22. | Brick sewer, South Bend, Ind. | | July 11 |
| July 22. | Sewer bonds, etc., Philadelphia, Pa. | | July 18 |
| July 22. | Pipe sewers, Boston, Mass. | | July 18 |
| July 22. | Broken stone, Baltimore, Md. | | July 18 |
| July 22. | Stone arch, Syracuse, N. Y. | | July 18 |
| July 22. | Sewers, etc., Syracuse, N. Y. | | July 18 |
| July 22. | Crib, stone, etc., Syracuse, N. Y. | | July 18 |
| July 22. | Electric wiring, Albany, N. Y. | | July 18 |
| July 22. | Macadamizing, Wabash, Ind. | | July 18 |
| July 22. | Hydrants, etc., Chicago, Ill. | | July 18 |
| July 22. | Water-wks. extension, Tomahawk, Wis. | | July 18 |
| July 22. | Water tower, Chicago, Ill. | | July 18 |
| July 22. | Asylum addition, Washington, D. C. | | July 18 |
| July 23. | Water-wks. system, Cape Vincent, N. Y. | | July 4 |
| July 23. | Flagging, Brooklyn, N. Y. | | July 11 |
| July 23. | Pipe sewers, Buffalo, N. Y. | | July 11 |
| July 23. | Stone and pier work, New York | | July 11 |
| July 23. | Bridge substructure, Defiance, O. | | July 11 |
| July 23. | Cleaning water basin, Waterbury, Conn. Advertised, Eng. News, July 18. | | July 18 |
| July 23. | Steel bridge, Troy, N. Y. | | July 18 |
| July 23. | Bridge, Albany, N. Y. | | July 18 |
| July 23. | Pipe sewers, Indianapolis, Ind. | | July 18 |
| July 23. | Curbing, etc., Kearney, N. J. | | July 18 |
| July 23. | Asphalt paving, Indianapolis, Ind. | | July 18 |
| July 23. | Bridge, Jersey City, N. J. | | July 18 |
| July 23. | Bridge superstructures (8), Mercer, Pa. | | July 18 |
| July 23. | Sewer pipe (2,100 ft.), Galena, Ill. | | July 18 |
| July 23. | Pipe sewers (2,200 ft.), Galena, Ill. | | July 18 |
| July 23. | Asphalt paving, Jersey City, N. J. | | July 18 |
| July 23. | Stop cocks, meters, etc., Jersey City. | | July 18 |
| July 23. | Canal work (3 contracts), Albany, N. Y. | | July 18 |
| July 24. | Suspension cableway, Washington, D. C. Advertised, Eng. News, July 4 and 11. | | July 4 |
| July 24. | Bridge pier, Providence, R. I. | | July 11 |
| July 24. | Pipe sewers (7,850 ft.), Urbana, Ill. Advertised, Eng. News, July 11. | | July 11 |
| July 24. | Parkway, Cleveland, O. | | July 18 |
| July 24. | Electric railway, etc., Buffalo, N. Y. Advertised, Eng. News, July 18. | | July 18 |
| July 24. | Postoffice building foundation, Buffalo. | | July 18 |
| July 24. | Pine paving, Fargo, N. Dak. | | July 18 |
| July 24. | Pig lead (15 tons), Baltimore, Md. | | July 18 |
| July 24. | Sewers, Colwyn, Pa. | | July 18 |
| July 24. | Boilers, Cleveland, O. | | July 18 |
| July 24. | Borings for new tunnel, Chicago, Ill. | | July 18 |
| July 24. | Cottages, etc., Topeka, Kan. | | July 18 |
| July 24. | Bridge piers, etc., Providence, R. I. | | July 18 |
| July 24. | Electric light plant ext'n, Washington. | | July 18 |
| July 25. | Electric light plant, Bellefontaine, O. | | June 20 |
| July 25. | Brick Paving, Lorain, O. Advertised, Eng. News, July 4 to 18. | | July 4 |
| July 25. | Lighthouse metalwork, New Orleans, La. Advertised, Eng. News, July 4 and 11. | | July 4 |
| July 25. | Water-wks. system, Warsaw, N. Y. | | July 4 |
| July 25. | Lighthouse, New Orleans, La. Advertised, Eng. News, July 4 and 11. | | July 4 |
| July 25. | Amusement hall, Washington, D. C. | | July 11 |
| July 25. | Sewer, Lawrence, Mass. | | July 11 |
| July 25. | Castings, Springfield, Mass., Armory. | | July 11 |
| July 25. | Water-works system, Warsaw, N. Y. Advertised, Eng. News, July 11 and 18. | | July 11 |
| July 25. | Iron bridges, Elkton, Md. | | July 11 |
| July 25. | Electric light plant, Aberdeen, Miss. | | July 18 |
| July 25. | Jail work, Cookeville, Tenn. | | July 18 |
| July 25. | Bridge substructures (6), Mercer, Pa. | | July 18 |
| July 25. | Macadamizing, etc., Indianapolis, Ind. | | July 18 |
| July 25. | Removing wreck, Boston, Mass. Advertised, Eng. News, July 18. | | July 18 |
| July 25. | Pipe sewers (12,910 ft.), Monticello, Ill. Advertised, Eng. News, July 18. | | July 18 |
| July 25. | Water-works system, Aberdeen, Miss. | | July 18 |
| July 26. | Water-works system, Monticello, Ind. Advertised, Eng. News, July 11 and 18. | | July 11 |
| July 26. | Post office building, Richmond, Que. | | July 11 |
| July 26. | School buildings, etc. (3), Buffalo, N. Y. | | July 18 |
| July 26. | Pipe sewers, Rochester, N. Y. | | July 18 |
| July 26. | Fire engine house, Rochester, N. Y. | | July 18 |
| July 26. | Water mains, Rochester, N. Y. | | July 18 |
| July 26. | Brick paving, etc., Louisville, Ky. | | July 18 |
| July 27. | Pipe (182 tons of 14-in.), Ithaca, N. Y. Advertised, Eng. News, July 18 and 25. | | July 18 |
| July 27. | Water-works system, Lockport, Ill. | | July 18 |
| July 27. | Street improvements, Evanston, O. | | July 18 |
| July 27. | Water-works system, Fowler, Ind. Advertised, Eng. News, July 18 and 25. | | July 18 |
| July 27. | Boiler, etc., Erie, Pa. | | July 18 |
| July 27. | Pipe sewers, Pittsburg, Pa. | | July 18 |
| July 27. | Brick culverts, Pittsburg, Pa. | | July 18 |
| July 27. | Bridge, Pittsburg, Pa. | | July 18 |
| July 27. | Sewage pumping station, Ithaca, N. Y. | | July 18 |
| July 27. | Sewers (12,000 ft.), Ithaca, N. Y. | | July 18 |
| July 27. | Old steel rails, Ithaca, N. Y. Advertised, Eng. News, July 18 and 25. | | July 18 |
| July 27. | Pumping engine, Buffalo, N. Y. | | July 18 |
| July 29. | Water-wks. system, Momence, Ill. Advertised, Eng. News, July 4 to 25. | | July 4 |
| July 29. | Cement (625 bbls.), Cincinnati, O. | | July 4 |
| July 29. | Sewers, Huntington, Ind. | | July 11 |

July 29. Artesian well, Cambridge, Ill.....July 11
July 29. Sewer pipe, etc., Washington, D. C...July 18
Advertised, Eng. News, July 18.
July 29. Brick paving, Monroe, Mich.....July 18
July 29. Asphalt paving, New York, N. Y.....July 18
July 29. Stand-pipe foundation, Cincinnati, O...July 18
July 29. Lift bridge, Brooklyn, N. Y.....July 18
Advertised, Eng. News, July 18 and 25.
July 29. City hall, etc., Cohoes, N. Y.....July 18
July 29. Water-wks. system, New Prague, Minn..July 18
July 29. Water-wks. system, Forrest, Ill.....July 18
July 30. Court house plans, Atchison, Kan.....July 4
July 30. Library building plans, Hoboken, N. J...July 11
July 30. Underground conduits, Cincinnati, O...July 11
July 30. Court house plans, Knoxville, Ia.....July 11
July 30. Electric light bonds, Riverside, Cal.....July 18
July 30. Bridge, Emmettsburg, Ia.....July 18
July 30. Building and wall, Brooklyn navy yard..July 18
July 30. Asphalt paving, Jersey City, N. J.....July 18
July 30. Belgian block paving, Jersey City, N. J..July 18
July 30. Dredging (465,000 cu. yds.), Brooklyn...July 18
Advertised, Eng. News, July 18 and 25.
July 30. Portland cement (8,000 bbls.), New York.July 18
July 30. Electric light plant, Ontonagon, Mich..July 18
July 30. Public building work, Detroit, Mich....July 18
July 31. Artesian well, Alvarado, Tex.....July 4
July 31. Electric light equipment, St. Clair, Pa..July 11
July 31. Sewers, Waterbury, Conn.....July 18
July 31. Reservoir work, Washington, D. C.....July 18
Advertised, Eng. News, July 18.
July 31. Brick paving, New Castle, Pa.....July 18
July 31. Bridge, Denver, Colo.....July 18
Aug. 1. Water-wks. system, Logan, O.....July 4
Advertised, Eng. News, July 4 and 11.
Aug. 1. Water-wks. franchise, West Rutland, Vt.July 11
Advertised, Eng. News, July 11 and 18.
Aug. 1. Armory at Camden, N. J.....July 11
Aug. 1. Granite block paving, Mobile, Ala...July 11
Advertised, Eng. News, July 11 to 25.
Aug. 1. Steel bridge, Ironton, O.....July 11
Aug. 1. Electric lighting, Shawano, Wis.....July 18
Aug. 1. Plans for penitentiary, Nashville, Tenn..July 18
Aug. 1. Fire engine house (3), Louisville, Ky.July 18
Aug. 1. Sewers, Grossdale, Ill.....July 18
Aug. 1. Macadamizing, Grossdale, Ill.....July 18
Aug. 1. Water-works, Shawano, Wis.....July 18
Aug. 1. Tramway and derrick, Detroit.....July 18
Aug. 2. Electric lighting, El Paso, Tex.....May 23
Aug. 2. Street improvements, Richmond, Ind..July 18
Aug. 3. Paving (14,000 sq. yds.), Mansfield, O..July 18
Advertised, Eng. News, July 18 and 25.
Aug. 3. Iron bridge, Cincinnati, O.....July 18
Aug. 3. Brick paving, Cincinnati, O.....July 18
Aug. 3. Artesian well, Bushnell, Ill.....July 18
Advertised, Eng. News, July 18.
Aug. 5. Levee wk. (700,000 cu.yds.), Rock Island.July 11
Advertised, Eng. News, July 11 to Aug. 1.
Aug. 5. Sewers, Orange, N. J.....July 18
Advertised, Eng. News, July 18 and 25.
Aug. 5. Pumping engine, Jackson, Tenn.....July 18
Aug. 5. Water-wks. system, Morristown, Tenn..July 18
Aug. 5. Water-wks. system, Schaller, Ia.....July 18
Aug. 5. State house work, Topeka, Kan.....July 18
Aug. 5. Highway bridge, Seattle, Wash.....July 18
Aug. 6. Court house, Dublin, Ga.....June 20
Aug. 6. Main sewer, Hammond, Ind.....July 18
Aug. 6. Artesian well, Jerseyville, Ill.....July 18
Aug. 7. Street improvement bonds, Toledo, O..July 18
Aug. 7. Boiler house, Cleveland, O.....July 18
Aug. 7. Iron bridge, Frankfort, Ind.....July 18
Aug. 8. Water-wks. system, Middleville, N. Y..July 18
Advertised, Eng. News, July 18 to Aug. 1.
Aug. 10. Paving, Springfield, Ill.....July 18
Aug. 12. Building addition, Los Angeles, Cal....June 27
Aug. 12. Bridge, Rock Island, Ill.....July 11
Aug. 13. Brick sewer, Indianapolis, Ind.....July 18
Advertised, Eng. News, July 18 and 25.
Aug. 13. Jail, Houston, Tex.....July 18
Aug. 15. Brick paving, Pontiac, Ill.....July 18
Advertised, Eng. News, July 18 and 25.
Aug. 15. Water bonds ($200,000), Cleveland, O..July 18
Aug. 16. Plans for school building, Buffalo, N. Y.July 18
Aug. 20. Capitol building, Olympia, Wash.....June 20
Aug. 20. Water-wks. system, Grand Junction, Col.July 18
Advertised, Eng. News, July 18 to Aug. 8.
Aug. 30. Timber (60 sq. miles), Ottawa, Ont....July 11
Sept. 5. State capitol plans, St. Paul, Minn....July 11
Sept. 10. Plans for city hall, Worcester, Mass...July 18
Sept. 14. Plans for library bldg., Madison, Wis..July 18
Sept. 18. Water-wks. franchise, Butte, Mont....July 11
Advertised, Eng. News, July 11 to Aug. 8.
Oct. 1. Plans for art building, Philadelphia, Pa..May 23
Advertised, Eng. News, May 23 to June 27.
No date. Asphalt paving, Newark, N. J.....July 18
" " .Granite paving, etc., Newark, N. J....July 18

## RAILWAYS.

### East of Chicago.

BANGOR & AROOSTOOK.—Press reports state that work on the Ashland branch will be commenced at once at Oakfield, Me. C. P. Treat, who built the main line, has the contract for the construction. Owing to this extension and other projected work in Aroostook county, the company has been granted an extension of four years, and, in certain contingencies, five years more, in which to build from Oldtown to Bangor. Pres., A. A. Burleigh, Houlton, Me.

CLEVELAND, CANTON & SOUTHERN.—It is stated that plans are being made for extending this railway from Bowerston, O., to Wheeling, W. Va. Gen. Man., J. W. Wardwell, Cleveland, O.

COUDERSPORT & PORT ALLEGANY.—The grading on the extension of this railway is about one-half completed, and tracklaying was commenced last week. It is expected to have trains running by Sept. 1. Geo. S. Good & Co., of Rock Haven, Pa., are the contractors, and Thos. J. Rogers, of Coudersport, Pa., the chief engineer.

JAMESTOWN & LAKE ERIE.—Press reports state that this railway will soon be extended from Clifton, one mile north of Jamestown, on Lake Chautauqua, to Falconer, to connect with the Dunkirk, Allegheny Valley & Pittsburg road. The surveys will be begun at once. Gen. Man., E. T. Haines, Jamestown, N. Y.

PENNSYLVANIA.—This company is reported to have effected a loan of $5,000,000, which will be spent for improvements, including the following: $1,500,000 for the new bridge across the Delaware River, at Philadelphia; $500,000 for removing grade crossings on the New York division, $500,000 for four-tracking and making other improvements east of Pittsburg, $600,000 for rebuilding bridge at Cincinnati, $250,000 for abolishing grade-crossings at Columbus, O.; $250,000 toward a union station at Dayton, O.; $200,000 for widening tunnels on the Pittsburg, Cincinnati, Chicago & St. Louis. The Cleveland & Marietta will have many grades eliminated, and the reports state that a large amount of new rolling stock will be purchased.

PITTSBURG, FORT WAYNE & CHICAGO.—Robt. Swan, of Allegheny, Pa., has prepared plans for the committee on grade crossings of the Allegheny councils for the removal of grade crossings in that city. The new plans of Mr. Swan provide for crossing Anderson, Sandusky and Federal Sts. by elevated tracks on iron pillars, and North, Washington and Pennsylvania Aves. by building overhead bridges for the traffic of the streets. Estimates made some years ago put the cost at $1,151,000 for the improvement. This company is reported as ready to commence work as soon as the plans are completed.

ROUGE RIVER & DEARBORN.—This company has been organized in Michigan to build a railway 5½ miles in length, according to the Detroit "Free Press."

### Southern.

ATLANTIC COAST LINE.—Grading is progressing on the branch from a connection with the Manchester & Augusta, 36 miles south of Sumter, S. C., south to Elloree, to connect with the Charleston, Sumter & Northern.

ALABAMA MIDLAND.—This company is reported as considering plans for a proposed extension from Luverne to Elba, in Coffey county, Ala. This road is a part of the Plant System. Gen. Supt., B. Dunham, Montgomery, Ala.

CHATTANOOGA SOUTHERN.—A new charter has been granted this company in Georgia on the application of Henry A. O. Post, Russell Sage, Thomas H. Hubbard, Newman Erb, Henry L. Lamb, E. A. C. Altman and Frank H. Davis. The capital stock is placed at $3,000,000.

CHESAPEAKE & WESTERN.—The commencement of construction on this road was noted in our issue of July 4. Maj. Jed Hotchkiss, of Staunton, Va., is quoted as stating that the line will connect the tidewaters of Virginia with the coal beds of West Virginia, and will be built as rapidly as men and money can construct the road. It will start from Matthias Point, on the Potomac River, and, proceeding west, pass through Fredericksburg, thence to Orange, or a point near there; thence to Elkton, on the Norfolk & Western, and thence to Harrisonburg, on the Baltimore & Ohio; from there to Bridgewater, on the North River, through the North Mountains westward to Monterey, and from there to the great coking coal fields of the Gauley Basin, with a terminus at some point on the Ohio River. It will thus traverse a great belt of unoccupied country between the Baltimore & Ohio and the Chesapeake & Ohio systems, and the entire length of the road will be something over 300 miles.

HINTON, NEW RIVER & WESTERN.—The construction of this railway, which was discontinued several months ago after a little preliminary work had been done, has been resumed in earnest at Hinton, W. Va., and will be continued along New River. At present about 200 men are employed, but this force will be doubled in a few days. The surveyors are at work at several points along the line. Summers county has voted to give $50,000 to the road. Pres., J. T. McCreery, Hinton, W. Va.

KOON'S RUN & BRIDGEPORT.—Incorporated in West Virginia July 12 to build a railway from Marion county to Bridgeport, in Harrison county, W. Va.; capital stock, $1,000,000, commencing with $500; principal place of business, Clarksburg, W. Va.; incorporators, Jos. M. Shinn, Adamsville, W. Va.; Chas. E. Manley, Fairmont, W. Va.; P. M. Long, Clarksburg, W. Va.; J. W. Wilkinson, Bridgeport, W. Va., and others.

MOBILE, JACKSON & KANSAS CITY.—The directors of this company met at the office of Nicol & Bond, at Mobile, Ala., July 3 and considered the proposed construction of the road. The citizens of Mobile are asked to subscribe $125,000, of which 25% would be payable when the line is in operation to Dog River, 25% when trains are running to Pascagoula, 25% when running to Augusta, and 25% when completed to Hattiesburg.

MURFREESBORO & WOODBURY.—J. E. Thompson, Murfreesboro, Tenn., the chief projector of a railway from that city to Woodbury, is quoted as stating that he has arranged with Jere Baxter, Pres. Tennessee Central, to have the line built and extended from Woodbury to Monterey, to connect with the Tennessee Central at that place, a total distance of about 70 miles.

NASHVILLE & MISSISSIPPI DELTA.—The incorporation of this company was recently noted. H. L. Underwood, Gen. Man., Birmingham, Ala., is quoted as stating that it is expected to begin active work in September on this road from Okolona, Miss., via Houston and Grayport, to Grenada, Miss., 71 miles. The entire line is surveyed, and there are 42 miles of old grade which it is proposed to utilize. The line will open up 200,000 acres of fine red and white oak timber land, besides hickory, pine and poplar, and will penetrate an excellent farming country. Pres., H. R. Elliott, Birmingham, Ala.

NORTH CAROLINA ROADS.—The railroad commission of North Carolina (composed of Col. J. W. Wilson, C. E.; E. C. Biddingfield and Otho Wilson) have just been engaged in assessing the railway property in that state. The commissioners inform our correspondent that at the end of the last fiscal year, which closed June 1, they find that there was only a very slight increase in railway building in that state over the previous year, but that considerable work is now being done and will be done during the next 12 months, so that the report of the commission for 1895-96 will show a large increase in the number of miles constructed during the next year over that of the preceding two years. Work is now progressing on three roads—the Aberdeen & West End, the Henderson & Brevard and the Caldwell & Northern—the latter road is being built from Lenoir, the county seat of Caldwell county, to Collettsville. The legislature last year chartered a dozen or more local railways, and work on several of them will begin this year. The commission has been informed that the 22 miles of the Henderson & Brevard road will be completed by Aug. 1. The construction for the year ending June 30 last was as follows: Winton R. R., 10 miles; Aberdeen & West End, 4 miles; Wellington & Powellsville, 11 miles; Aberdeen & Rockfish, 5½ miles; Moore County R. R., 12 miles; total, 41½ miles. Making the total mileage of railways now in operation in that state 3,655¼ miles.

SAVANNAH, AMERICUS & MONTGOMERY.—Press reports state that contracts have been awarded for the steel rails for building a line between Meldrim and Savannah, 19 miles, and that the road will eventually run into Savannah over its own tracks the entire distance, the present plans including a traffic arrangement between Lyons and Meldrim.

TALLASSEE & MONTGOMERY.—This company was recently incorporated in Alabama by I. W. Durr, of Montgomery, Ala.; A. J. Milstead and N. H. Micou, of Tallassee. It is stated that a railway will be built from Tallassee, near Montgomery, where important cotton mills are located, to Goodwyn Station, on the Western Ry. of Alabama, a distance of eight miles. An iron bridge is to be erected near Goodwyn, over the Tallapoosa River, and work is to be commenced as soon as the bids are let. A committee of the Tallassee company has concluded the details of an agreement for the operation of the road, when built, by the Western Ry. of Alabama.

WEST VIRGINIA CENTRAL & PITTSBURG.—It is reported that this railway, in which Stephen B. Elkins, Richard Kerens, and ex-Senator Davis are interested, is to be extended to connect with the Chesapeake & Western in Highland or Pocahontas county, W. Va.

WEST VIRGINIA SOUTHERN.—Incorporated in West Virginia July 10; capital stock, $500,000; incorporators, R. I. Herndon, C. C. Watts, J. W. Carkson and Russell G. Quarrier, of Charleston, W. Va., and Joseph Renshaw, of Baltimore, Md. It is stated that Jos. Renshaw is the principal stockholder, and that the railway will connect the Chesapeake & Ohio at Brownstown with the Coal River coal fields. The road will be about 40 miles in length.

### Northwest.

ILLINOIS TERMINAL.—A press report from Alton, Ill., states that this company has been incorporated there with a capital stock of $50,000 to improve and control the terminal of the various railways doing business in Alton. The tracks are to extend from the lands of the Illinois Glass Co. at Alton to the east approach of the Burlington bridge over the Mississippi River at Alton, and to such points within the city of Alton as may be permitted. The directors are William Eliot Smith, R. Harry Levis, Charles Levis, and Harry H. Ferguson, of Alton, and George M. Levis, of Upper Alton.

VALLEY TERMINAL.—The contract for building the 38 miles of road to Green Bay, Wis., will probably be let within a few days. The line is to be built from Neenah, at the north end of Lake Winnebago, to Green Bay, passing through the towns of Appleton, Kimberly, Combined Locks, Kaukauna, Wrightstown and De Pere. The "Railroad Gazette" states that the construction of the line for a portion of the way will be expensive. The 20 miles of the north end, near Green Bay, will be ordinary rail work, but the south end is more broken with bridges and trestles. The average grade is about 26 ft. to the mile. There will be one swing bridge over the Fox River at Appleton and a number of other bridges and trestles. The officers of the company are: Pres., John J. Macintire, Niagara Falls, N. Y.; Vice-Pres., George E. Green, Binghamton, N. Y.; Secy., Walter B. Pelton, Appleton, Wis.; Treas., Joseph Taylor, Detroit; Ch. Engr., D. C. Dunlap, Chicago.

### Southwest.

CARTHAGE & STOTTS CITY.—A. W. Nesbit, of Stotts City, a mining camp in Lawrence county, Mo., is quoted as stating that the owners of the mining property at that place have guaranteed the capital necessary to construct a railway to Carthage, Mo., 22 miles. The present output of the mines amounts to about $2,000 a week, and has to be hauled to Carthage or to Mount Vernon, eight miles distant.

KANSAS CITY, PITTSBURG & GULF.—A report from Shreveport, La., states that Shreveport and Caddo Parish have voted a tax to aid in the construction of this road, amounting to $345,000. This insures the building of the road to Shreveport during this year, and the erection of its general shops there. Sixty-nine thousand dollars were also voted to the Missouri & Kansas R. R. to induce it to build a branch into Shreveport. This will make Shreveport one of the most important railway centers in the south.

NEW ORLEANS & WESTERN.—The incorporation of the Delta Construction Co. at New Orleans to build this road was recently noted. Bids were received June 28 for building a portion of the road. The new railway is to be a belt line 20 miles around the city of New Orleans, beginning at Avondale, in Jefferson parish, running through the swamps back of New Orleans and connecting with all railways, and ending at the Battle Ground Plantation, 1½ miles below New Orleans, in the parish of St. Bernard. The Battle Ground Plantation is four miles square, with a river front of one mile, and is owned by this company, and will be used as the general terminal for New Orleans. A large grain elevator is now under contract, also the two largest compressors in this country. Plans are being made for warehouses to hold 250,000 bales of cotton, together with one mile front of wharf, with separate places for fruit, lumber, cotton and cottonseed oil products. Ch. Engr., A. W. Swanitz; Asst. Engr., Chas. B. Beason, both of New Orleans; Pres., J. L. Nisbet, of 40 Wall St., New York.

ST. JOSEPH & SOUTHERN.—The St. Joseph, Mo., "Herald" states that J. W. Boyd, Pres., and W. M. Rush and J. W. Brockett, directors, are making earnest efforts to secure the construction of this railway between that city and Trenton.

STATE LINE, STILLWATER & WESTERN.—Press reports state that this company has been organized at Stillwater, Okla., with the following officers: Pres., Frank J. Wickoff; Vice-Prests., H. E. Hand and C. P. Rock; Treas., H. W. Kiser; Sec., F. C. Hunt; Supt., W. F. Hodges. The company proposes to build a branch from the Atchison, Topeka & Santa Fe to Stillwater and southwest to the Choctaw coal fields.

### Rocky Mt. & Pacific.

ALAMEDA & SAN JOAQUIN.—Surveys are being made for this railway from Corral Hollow to Stockton, Cal., and the council of Stockton is considering the granting of a franchise on several streets in the city. Ch. Engr., Geo. A. Atherton, Stockton, Cal.

SONOMA, MENDOCINO & HUMBOLDT.—Press reports from Healdsburg, Cal., state that this company has been organized and that preliminary surveys have

been completed for the immediate construction of a standard gage railway from Healdsburg through Dry Creek and Anderson valley to Eureka, a distance of 170 miles, with a branch line at Fort Bragg extending to the coal fields of Round valley; capital stock $6,250,000, of which a large amount has already been subscribed by Chicago and New York capitalists. In a statement for the press, Mr. Lester, Ch. Engr., says that the men back of this enterprise mean business, and will extend the Albion road to Healdsburg if they get any encouragement. The Albion road will be extended to Anderson valley, and a boat line put on between Fort Bragg, Mendocino, Albion and San Francisco, to connect with trains from Anderson valley until the line is completed.

### Foreign.

CORO & LAVELA R. R. & IMPROVEMENT CO.—Incorporated in New Jersey July 15 to build a railway between Coro and Lavela, Venezuela; capital stock, $500,000, with $500 paid in; incorporators, Adolph Cereira and Francisco Bonilla, of Brooklyn, N. Y., and Geo. L. Dayton, of Jersey City, N. J.

MEXICAN CENTRAL.—A press report from Tula, Mex., states as follows: The Mexican Central R. R. Co. has decided to build a short line connecting the city of Mexico with Tampico. The line will start at Tula, and will follow the valley of Panuca River all the way to Tampico. At present the route between the city of Mexico and Tampico is via San Luis Potosi. The rapid growth of the business interest through Tampico makes an absolute necessity for a shorter route to the city of Mexico. The engineers are now employed in running the surveys of the new line. It will reduce the time between the city of Mexico and Tampico to 10 hours.

### STREET AND ELECTRIC RAILWAYS.

BANGOR, ME.—The Bangor, Orono & Oldtown Ry. Co. has petitioned the state board of railroad commissioners for permission to construct its road; Pres., A. F. Gerald.

MANCHESTER, N. H.—A correspondent writes us that the new electric railway was dedicated July 4. It is now broad gage, and is laid with 9-in. girder rails on Elm St. and T-rails on side lines. The General Electric Co., of Schenectady, N. Y., furnished the electrical equipment, and the Laconia Car Co., of Laconia, N. H., the cars.

SOUTHBRIDGE, MASS.—It is reported that subscriptions to the amount of $30,000 have been secured towards the $35,000 needed to aid in the construction of an electric railway between Saundersville and Fiskdale, seven miles, and estimated to cost $70,000. John M. Cochran, of this place, has appointed a committee to secure subscriptions from Sturbridge.

WESTFIELD, MASS.—The Woronoco St. Ry. Co. has voted to adopt the trolley system and is considering bids. Gen. Man. and Supt., J. Finnell.

NEW BRITAIN, CONN.—It is reported that W. H. Caldwell, of the Central Ry. & Electric Co., has been surveying two new routes to Newington from Jubilee St. The company has petitioned the council for permission to extend its road to Jubilee St. and the new routes are being surveyed in order that the company may ascertain which is the better of the two for its purpose of connecting with Newington.

NEW LONDON, CONN.—It is reported that surveys will soon be begun for extending the New London St. Ry. Co.'s electric road. It is expected that work will be commenced in the fall and be completed by May, 1896. Supt., L. Bentley; Electrician, E. A. Brown.

WESTPORT, CONN.—The Westport & Saugatuck Horse R. R. Co. has been granted permission to increase its capital stock to $100,000 for extending its road and equipping it with electricity. Gen. Man. and Supt., H. E. Jackson.

BUFFALO, N. Y.—Bids are asked until July 24 for constructing about 3½ miles of single track electric railway and furnishing one 75 K-W. generator, two trucks, four 25-HP. motors, etc., for the Buffalo, Gardenville & Ebenezer Ry. Co., as stated in our advertising columns. Pres., Charles Schoepflin; Attorneys, Hodson & Webster, Dun Bldg.; Engrs., Voorhees & Witmer, Chapin Block, Buffalo.

MIDDLETOWN, N. Y.—The Middletown-Goshen Traction Co. is considering the question of extending its electric road to the state hospital by making a cut on West Main St., beginning near Bonnell St., so as to pass under the tracks of the New York, Lake Erie & Western Ry. Gen. Man., W. B. Rockwell; Ch. Engr., G. H. Smith.

NEW YORK, N. Y.—Upon the application of the People's Traction Co. for permission to build an electric railway 21½ miles in length in the 23d and 24th wards, the aldermen have voted in favor of the road, and the franchise will be sold at auction to the highest bidder. The company will operate the road for 15 years, in connection with the New York, Westchester & Connecticut Traction Co., which proposes to build an electric road to the Connecticut state line.

PORT JERVIS, N. Y.—Arrangements are being made to construct the Port Jervis & Suburban Electric St. Ry. at an early date, according to reports. H. H. Archer, of Scranton, Pa., is interested.

SYRACUSE, N. Y.—The Syracuse St. R. R. Co. has been granted permission to extend its electric road to Woodlawn, and to make several connections. Gen. Man. and Electrician, W. R. Kimball; Ch. Engr., H. S. Horton.

WATKINS, N. Y.—The Watkins & Havana Electric R. R. Co. has accepted the franchises granted it by Watkins, Montour Falls and Dix. Pres., J. E. Mulford, of Montour Falls; Vice-Pres., Chas. S. Frost., of Watkins; Secy. and Treas., C. L. Hathaway, of Horseheads; Gen. Man., C. H. Baldwin, of Elmira.

BRADDOCK, PA.—The Braddock Electric Passenger Ry. Co. has voted to call for a second assessment on its capital stock to complete its railway in Braddock. The road was built several years ago, but has not been operated for three years because of an injunction secured against it by the Pennsylvania R. R. on account of the grade crossing at Copeland station. The railway will be bridged at Copeland, and the line extended to East Pittsburg and westwardly to Wilkinsburg. The proposed improvements will cost over $50,000. The line is now four miles long, and the extension will add four more miles.

PHILADELPHIA, PA.—Press reports state that the Philadelphia Traction Co. has petitioned for charters for the following companies: The Philadelphia, Lancaster & Harrisburg R. R. Co.; capital stock, $6,000,000; incorporators, J. J. Patterson, J. H. Brown, J. D. Skiles, J. G. Zook, Michael Reilly, M. L. Herr, Henry Yeagley, S. H. Reynolds, and H. C. Hopkins; this road is to connect Lancaster and Reading. The Lititz & Manheim R. R. Co.; capital stock, $50,000; and the Lancaster, Ephrata & Reading R. R. Co.; capital stock $70,000. For both of these the applicants are the same as for the first company.

PITTSBURG, PA.—It is reported that the Pennsylvania R. R. Co. is considering the question of equipping the branch of its road to Walls, Pa., with electricity.

BALTIMORE, MD.—Wm. H. Whitridge, Pres. South Baltimore Land Co., and J. J. Alexander, attorney, have filed a petition with the Baltimore county commissioners at Towson, asking for the privilege of constructing a single or double track railway from the company's lands to Meeter's pavilion. The proposed railway will begin at a point on Gwynn's Falls and pass through the property of the South Baltimore Land Co. to the Annapolis Road on Maryland Ave.

BALTIMORE, MD.—The Washington, Sandy Springs & Baltimore Electric Ry. Co. has been incorporated to build a railway from Tacoma Park, Montgomery county, through Burnt Mills, Sandy Springs, and Ellicott City, then through the first district of Baltimore county to the Baltimore city line, where connections will be made with the City & Suburban Ry. Capital stock, $1,500,000. It is proposed to build a telegraph and telephone line, and to furnish electric lights and water-power to Sandy Springs, Clarksville, Columbia, and Ellicott City, and other places through which the road will pass. Incorporators, James B. Colegrove, Wm. F. Sliney, Allen Freas, F. Ray Keys, and B. H. Colegrove.

GRETNA, LA.—Messrs. Morse & Gerdes and R. T. Waldo are reported to have petitioned for franchises to build an electric road in Jefferson parish; the first is to extend from East Carrollton to East End and the second from Upperline to Kennerville.

NEW ORLEANS, LA.—The property of the Canal & Claiborne R. R. Co. has been sold by the E. J. Hart family, which controlled the road, to Philadelphia and local capitalists. The road is about 13 miles in length, and will be extended six miles, and the entire system equipped with electricity. It is reported that other extensions are to be petitioned for. The following are the officers of the reorganized company: Pres., Joseph H. De Grange; Secy., B. J. De Grange, of New Orleans; directors, J. W. Castle, Pres. Hibernia National Bank; Harris Hyman, of Hyman, Hiller & Co.; J. K. Newman, I. S. West and B. J. Montgomery.

BOSTON, O.—The Glauga Central Transit Co. has been incorporated to build an electric railway from Middleburg to Russell township, by way of Burton and Newburg townships; capital stock, $10,000; incorporators, P. W. Parmell, P. T. Thompson, W. S. Williams and E. M. Youmans.

YOUNGSTOWN, O.—It is reported that the Park & Falls Electric R. R. Co. has applied to the county commissioners for franchises for electric roads from the south city limits to Poland and to North Lima. This company is just finishing a railway from South Market St. to the south city limits. Henry Hamilton and D. F. Anderson are interested.

OSHKOSH, WIS.—Charles Barber, Geo. L. Madison and Joseph H. Porter have been appointed a committee by the Oshkosh St. R. R. Co. to secure estimates for equipping the road with electricity. Gen. Man. and Supt., C. E. Montgomery.

PARAGOULD, ARK.—B. M. Harrison, of the Harrison Electric Co., of Chicago, with J. D. Block and others, of Paragould, are reported as interested in a projected electric road from Siloam Springs, Ark., through Paragould to Gayoso, Mo., on the Mississippi River.

### ELECTRIC LIGHT AND POWER.

FORT FAIRFIELD, ME.—Arrangements are being made for constructing an electric light plant at Stevens' Mills, according to reports.

RANDOLPH, VT.—The question of constructing an electric light plant is being discussed, and an effort is being made to purchase a water power at Gaysville for this purpose.

ALBANY, N. Y.—Bids are asked until July 22 for the electric wiring of the state armory building at Washington Ave. and Lark St. Arch., I. G. Perry; Adj. Gen., Edwin A. McAlpin.

FRIENDSHIP, N. Y.—It is reported that this place is to have electric lights.

TROY, N. Y.—The Beacon Electric Lighting Co. has been awarded the contract for lighting Lansingburg, for which an appropriation of $13,000 has been made.

BLAIRSTOWN, N. J.—Chas. H. Christian, of Branchville, has been awarded the contract for erecting the electric light plant at Blairstown.

WENONAH, N. J.—The question of putting in electric lights is being considered.

MECHANICSBURG, PA.—It is reported that the council has awarded the contract for lighting this place by electricity to the C. L., H. & P. Co.

POTTSVILLE, PA.—It is reported that plans and specifications have been prepared by the county commissioners for the new electric light and heating plant for the new hospital building at the almshouse. The building will be 54 × 100 ft., constructed of iron and brick, and contain a high-speed engine of 75 or 100 HP.; also two dynamos; estimated cost of the two buildings, $65,000 to $70,000.

WASHINGTON, D. C.—Bids are asked until July 24 for extending the electric light plant at the navy yard. E. O. Matthews, Ch. of Bureau of Yards and Docks.

NORTH CAROLINA.—Our correspondent writes us that the Caroleigh Cotton Mills, at Raleigh, will at once put in a 200-light electric light plant, and several of the mills mentioned under the head of Manufacturing Plants will also put in electric light plants as a part of the equipment. The Riverside Cotton Mills at Island Ford, N. C., now building, will put in an electric light plant; also the Minneola Mills, at Gibsonville, N. C.

ATHENS, GA.—The council has called an election to vote on the question of issuing $25,000 in bonds for a municipal electric light plant.

PRATTVILLE, ALA.—The construction of an electric light plant is being discussed, according to reports.

ABERDEEN, MISS.—Bids are asked until July 25, according to reports, for constructing an electric light plant of 50 arc and 2,500 incandescent lights, including a 50 to 60-HP. steam engine and boiler. R. L. Hull, Mayor.

McCOMB, O.—W. A. Shelt, of Napoleon, O., has made a proposition to the village to put in an electric light plant.

ESCANABA, MICH.—The city is reported to have offered $70,000 for the electric light plant now operated by a company, as it is proposed to establish a municipal plant.

LOWELL, MICH.—Bids are asked until July 20 for lighting the streets with electric lights. A. W. Burnett, Village Clk.

ONTONAGON, MICH.—Bids are asked until July 30 for constructing an incandescent electric light plant. Engr., C. F. Loweth, 94 East 4th St., St. Paul, Minn.; W. L. Stewart, Village Recdr.

EVANSTON, ILL.—The council has granted the Evanston Illuminating Co. a 25-year franchise in North Evanston and other districts lately annexed to this city.

SHAWANO, WIS.—Bids are asked until Aug. 1 for furnishing electric lights and building water-works. B. H. Garfield, Chn. Com.

MILWAUKEE, WIS.—The board of public works is reported about to advertise for bids for lighting the streets and public buildings with electricity. The contract with the Badger Illuminating Co. expires Jan. 1, 1896.

MANKATO, MINN.—The citizens have voted by a majority of 235 to issue $10,000 in bonds for an electric light plant.

PRINCETON, MINN.—Fairbanks, Morse & Co. have been awarded the contract for putting in an electric light plant and water-works, work on which will begin about Aug. 1.

NORTONVILLE, KAN.—It is reported that the question of constructing an electric light plant is being considered.

VINTON, IA.—Bids were asked until July 17 for constructing an electric light plant. J. E. Whipple, Cy. Clk.

RIVERSIDE, CAL.—Bids are asked by the city clerk until July 30 for the purchase of electric light and street improvement bonds.

WINDSOR, ONT.—It is reported that the council will advertise for bids for a new boiler and for other improvements to the electric light plant, estimated to cost $5,000.

NEW COMPANIES.—Reed City Electric Co., Reed City, Mich.; $10,000; Chas. A. Kinnel, Laura Thomas.

Mexia Lighting & Power Co., of Mexia, Tex.; $15,000; John W. Shoaf, Wm. L. Hall, Wm. L. Murphy.

Pocatello Electric Light & Power Co., Chicago, Ill.; $15,000; Chas. W. Spalding, Daniel Swinehart, Francis W. Smith.

Economy Electric Lighting Co., Geneva, O.; $12,000; J. A. Carter, C. H. Munger, Lucien Seymour, C. L. Chamberlain.

Defiance Light & Fuel Co., Defiance, O.; $50,000; Wm. R. Faber, James W. R. Cline, Wm. R. Morrison, O. P. Martin.

Southern Electric Service Co., Norfolk, Va.; $175,000; Wm. R. Brown, Sing Sing, N. Y.; Treas., Mr. Hobbs, Stony Point, N. Y.

Lampasas Electric Light Co., Lampasas, Tex.; $1,000; J. T. Donovan, Sr., E. A. Maxwell, W. L. Donovan, W. H. Browning, J. C. Mathews.

Mercantile Gas & Electric Light Co., San Jose, Cal.; $500,000; J. V. McKiernan, Frank Whittaker, E. C. Randall, W. W. Wood, C. K. Fleming.

Pekin Electric Light & Power Co., Pekin, Ill.; capital stock increased from $15,000 to $50,000; Pres., George Herget; Secy. and Treas., Thomas Cooper.

Easton Power Co., Easton, Pa.; $100,000, with $2,000 paid in; Howard Lacy, Albert B. Carter, Thos. A. Hay, Wm. O. Hay, of Easton, and Asa W. Dickinson, of Hackensack, N. J.

Manheim Electric Light, Heat & Power Co., Manheim, Pa.; $20,000, with $2,000 paid in; Treas., Vance C. McCormick, of Harrisburg; directors, H. B. McCormick, Robt. A. Carl, of Harrisburg.

### BRIDGES.

LEWISTON, ME.—The King Bridge Co., of Cleveland, O., has been awarded the contract for building a new 90-ft. iron bridge over the Little Androscoggin at Main St., at $3,400.

LOWELL, MASS.—The question of constructing a bridge, 60 ft. in length, at Moody St., is being considered.

PROVIDENCE, R. I.—Bids are asked until July 24 for constructing abutment walls and masonry piers for the Exchange St. bridge over the Providence River. Robt. E. Smith, Comr. Pub. Wks.

MIDDLETOWN, CONN.—Plans have been prepared for a new bridge between Middletown and Portland. It is reported that the Berlin Bridge Co. is to build the bridge. Henry A. Cornwall, Gen. Agent of the Middlesex Quarry Co., is interested.

ALBANY, N. Y.—Bids are asked until July 23 for constructing a bridge over the inlet to Otisco Lake. Thomas Wheeler, Asst. Supt. Pub. Wks., Rochester; Geo. W. Aldridge, Supt. Pub. Wks.

BROOKLYN, N. Y.—Bids are asked until July 29 for constructing a lift bridge over Newtown Creek, between Manhattan Ave., Brooklyn, and Vernon Ave., Long Island City, as described in our advertising columns. John J. McLaughlin, Engr., Jamaica, N. Y.; Theodore Koehler, Chn. Joint Com.

BUFFALO, N. Y.—The Hilton Bridge Co., of Albany, has been awarded the contract for constructing the substructure and the superstructure for the bridge over the Erie Canal, at Mill St., at $6,945.——The grade crossing commission has approved the construction of a viaduct at the intersection of Elk St. and Abbott Road, with incline approaches from each of these streets, instead of one viaduct over the Erie tracks crossing Abbott Road, and another over the Lake Shore tracks crossing Elk St. This will lessen the cost of the work by about $75,000.

ITHACA, N. Y.—K. P. Crandall, Engr., has sent us a statement of the bids received July 10 for a highway bridge across Six Mile Creek. Line A calls for a bridge 300 ft. in length and line B for one of 360 ft.;

roadway in both about 70 ft. above bed of creek. Bridge to have 24 ft. roadway, with two 5-ft. sidewalks, to conform to Cooper's specifications, Class B, with a slightly higher factor of safety. The contract was finally awarded to the Owego Bridge Co. at $19,000, the council to have the right to select either route. Plan a braced arch 260 to 280 ft. span with trestle approach:

| | Line A. | Line B. |
|---|---|---|
| Massillon Bridge Co., Massillon, O. | $19,900 | .... |
| Horseheads Bridge Co., Horseheads, N. Y. | 19,500 | .... |
| Groton Bridge Co., Groton, N. Y. | 18,999 | $21,999 |
| Havana Bridge Co., Havana, N. Y. | 19,050 | 22,051 |
| Penn Bridge Co., Beaver Falls, Pa. | 19,900 | 22,900 |
| Berlin Iron Bridge Co., East Berlin Conn. | 19,677 | 22,975 |
| Champion Bridge Co., Wilmington, O.* | 22,500 | .... |
| Detroit Bridge Co. Detroit, Mich. | 20,250 | 23,000 |
| King Bridge Co., Cleveland, O. | 20,000 | 23,250 |
| Owego Bridge Co., Owego, N. Y. | 19,246 | 22,400 |

* Informal.

ROCHESTER, N. Y.—The state has appropriated $25,000 for a new bridge over the canal at Exchange St. The city engineer has recommended that a $50,000 bridge be built, and has suggested that the taxpayers interested pay the extra $25,000, and next year petition the legislature to refund the money.

STAPLETON (S. I.), N. Y.—The supervisors have decided to build a bridge over the Fresh Kill between Westfield and New Springfield, at an estimated cost of about $12,500, of which $9,000 will be spent for the wooden trestle over the marshes. Abram Cole, of Westfield, and Edward P. Doyle, supervisors.

SYRACUSE, N. Y.—Bids are asked until July 22 for constructing a stone culvert and a stone arch over the Harbor Brook at Park Ave. and at West Genesee St. H. F. Stephens, Cy. Clk.

TROY, N. Y.—Bids are asked until July 23 for building a bridge over the Fitchburg tracks at Rensselaer St. The bridge will have two spans, one 100 ft. long and the other 171 ft., and will be 18 ft. in width. E. O. Ross, Secy. Contracting Bd.

YONKERS, N. Y.—It is reported that the iron bridge over the railway tracks on Maine St. is unsafe, and that two of the iron girders have rotted and rusted away.

ELIZABETH, N. J.—The committee appointed by the board of freeholders of Union county have recommended the construction of a new iron bridge, 75 ft. span, over the Rahway River at Eastman St., Cranford, at a cost of about $3,000; the construction of an iron bridge over Green Brook at Clinton Ave., Evona, at a cost of about $1,000, and the widening of the Grand St. bridge at Rahway, at a cost of about $1,800. S. H. Ryno, Clk.

JERSEY CITY, N. J.—Bids are asked until July 23 for constructing a bridge over Conellson Ave., at Montgomery St. John C. Kaiser, Chn. St. Com.

CARLISLE, PA.—The following bids were received July 9 by J. D. Hemminger, Clk. Bd. County Comrs., for constructing an iron bridge over Condoquinet Creek at Wolf's Ford, Middlesex township. All of the bids have been rejected:

| | Sub and Filling | | |
|---|---|---|---|
| | superst'cture. | Filling approaches. | Total. |
| King Bridge Co, Cleveland, O. | $6,950 | $675 | $7,625 |
| Massillon Bridge Co., Massillon. | 7,000 | ... | 7,000 |
| Pittsburg Bridge Co., Pittsburg. | 7,500 | ... | 7,500 |
| Dean & Westbrook, New York. | 6,750 | 540 | 7,290 |
| Horseheads (N. Y.) Bridge Co. | 6,740 | 510 | 7,250 |
| Toledo Bridge Co., Toledo, O. | 6,750 | 475 | 7,225 |
| Champion Bridge Co., W'm'gton | 6,675 | 438 | 7,113 |
| Austin Mfg. Co. | 6,737 | 475 | 7,212 |
| Iron Substructure Co, Columbus. | 6,800 | 400 | 7,200 |
| Groton Bridge & Mfg. Co. | 6,590 | 475 | 7,065 |
| Vanity Iron Works, Cleveland. | 6,600 | 425 | 7,025 |
| Berlin Iron Bridge Co. | 6,595 | 425 | 7,020 |
| Columbus Bridge Co., Columbus. | 6,683 | 300 | 6,983 |
| Wrought Iron Bridge Co. | 6,145 | 420 | 6,565 |
| Nelson & Buchanan, Chamb'sb'g. | 6,149 | 300 | 6,449 |

McKEESPORT, PA.—Homer Swaney and others are interested in a projected one-span bridge, 325 ft. in length and 50 ft. in height, over the Youghiogheny River, at this place.

MERCER, PA.—Bids are asked until July 23 for constructing superstructures for eight iron one-span county bridges, one of which is over the Shenongo River, at Wheatland, and will have a clear span of 170 ft., the others are for rivers 46½ to 20 ft. in width; and until July 25 for the stone work for six of the above bridges. Geo. E. Hamilton, Clk. County Comrs.

OIL CITY, PA.—Press reports state that the Allegheny Valley R. R. bridge across the river at this place will be replaced in the course of a few months with a steel structure, which will cost about $50,000. The necessary timbers for the falsework are now being delivered.

PITTSBURG, PA.—Bids are asked until July 27 for constructing an iron and steel bridge over Panther Hollow, in Schenley Park. E. M. Bigelow, Dir. Pub. Wks.

PITTSBURG, PA.—This city proposes to build two bridges at the entrance of Sheuley Park; a stone arch of about 150 ft. span, and a steel viaduct about 550 ft. long, both of which will have two sidewalks and a wide driveway. E. M. Bigelow, Dir. Pub. Wks.——The Tenth St. bridge, a covered wooden structure over the Monongahela River, will be replaced by a modern steel structure of one span each of 500, 320, 250 and 200 ft., designed for double-track electric line and two sidewalks. The Drake & Stratton Co. has the contract for the foundations and the Keystone Bridge Works will build the steel work.——The construction of an iron and steel bridge across Panther Hollow in Schenley Park, between the conservatory and the Zoo is being considered. It will be 620 ft. in length, main arc being 320 ft.; height above bottom of Hollow, 115 ft.; roadway, 40 ft.; sidewalks, 10 ft.; estimated cost, $125,000.

SCRANTON, PA.—The following bids were received July 11 for constructing approaches to Spruce St. bridge; approximate estimate, $15,051: Hart & Gibbons, Wilkes Barre, $13,400; Peter Stipp, Scranton, $13,450; V. H. O'Hara, Scranton, $13,791. Joseph P. Phillips, Cy. Engr.

TUNHANNOOK, PA.—It is reported that the council has appointed a committee to make a contract for building an iron bridge over Swail Brook, at the Turnpike street crossing.

BALTIMORE, MD.—Elihu Cuddy and others, of Monkton, have petitioned the county commissioners for the erection of a bridge over Gunpowder River, on the Pleasant Valley road.

NEW BERNE, N. C.—The construction of a bridge over the Neuse River, and one over the Trent River, at this place, at an estimated cost of about $40,000, is being agitated.

ST. AUGUSTINE, FLA.—Henry M. Flagler has been granted permission to build a highway bridge over Lake Worth, between Palm Beach and West Palm Beach. The specifications call for a pile structure of wood with a 50-ft. opening for a steel draw. It is reported that the bridge will be completed this fall.

CINCINNATI, O.—Bids are asked until Aug. 3 for building a wrought iron Pratt truss bridge, with new abutments, over West Fork of Mill Creek on the Hamilton and Martin road. Geo. C. Zimmerman, Clk. Bd. Hamilton County Comrs. The county commissioners, on the recommendation of the engineer, have voted to appropriate $3,940 for a new superstructure for the Rapid Run bridge.

CAMBRIDGE CITY, IND.—We are informed that a bridge is to be erected at this place.

FRANKFORT, IND.—Bids are asked until Aug. 7 for constructing an iron bridge of one 100-ft. span, with two stone abutments. Address Charles E. Boulden, Surveyor's Office.

DETROIT, MICH.—The board of public works is considering the plans prepared by the city engineer for a viaduct at Garfield Ave. estimated to cost $25,000 to $30,000.

CHICAGO, ILL.—The commissioner of public works has awarded the contract for constructing the substructure of Diversey St. bridge to Leyden & Drews, at $14,526, and the contract for the superstructure to the Lassig Bridge & Iron Works, at $14,790.

MILWAUKEE, WIS.—The committee of the board of public works is considering the question of constructing a viaduct over the railway tracks at Muskego Ave., at an estimated cost of $25,000 to $30,000.

OSCEOLA, WIS.—The construction of a bridge over the St. Croix River at this place, at an estimated cost of $12,000 to $25,000 is again being considered.

PLYMOUTH, WIS.—The council has adopted plans and specifications for a Melan arch, and at the same time resolved that the royalty be paid by the city, so that bids will be open to all contractors.

BOONE, IA.—J. H. Killmar, of the firm of Higgins & Killmar, Consulting Engrs., Des Moines, Ia., is in charge of plans and work on the Des Moines River bridge at this place. The contract has been awarded to the King Bridge Co., Cleveland, at $16,000.

EMMETTSBURG, IA.—Bids are asked until July 30 for constructing a 100-ft. span iron or steel bridge with foundations. C. W. Hodgkinson, County Audr.

ST. PAUL, MINN.—The city clerk has been directed to advertise for new bids for constructing the superstructure for the Como Ave. bridge.

DENVER, COLO.—Bids are asked until July 31 for constructing a bridge across White River in Rio Blanco county, near, Rangely, at an estimated cost of $3,500. H. A. Sumner, State Engr.

MAMMOTH SPRING, ARK.—It is reported that the bids for constructing an iron bridge over South Fork have been rejected, and that the work will be readvertised.

HOUSTON, TEX.—The city engineer has been directed to prepare plans for a bridge across Buffalo Bayou at Hill St., estimated to cost $35,000.

SEATTLE, WASH.—Bids are asked until Aug. 5 for constructing a highway bridge of one 112-ft. span over Green River at Palmer, King county. Nathan Beman, County Audr. and Clk. Bd. County Comrs.

## BUILDINGS.

WORCESTER, MASS.—Plans are asked by the mayor until Sept. 10 for a new city hall, to cost not more than $300,000. The report states that the successful architect is to have the superintendence and be paid a percentage on the cost, the authors of the four next best designs to receive prizes as follows: $2,000, $1,500, $1,000 and $500. The awards will be made by a committee consisting of the mayor, superintendent of public buildings, and a disinterested architect to be selected by the mayor.

BROOKLYN, N. Y.—Bids are asked until July 30 for reconstructing building No. 115 and the quay wall inside Whitney Basin at the Brooklyn navy yard. Address E. O. Matthews, Ch. of Bureau of Yards and Docks, Washington, D. C.

BUFFALO, N. Y.—Plans are asked until Aug. 16 for a 16-room school building on the Mineral Spring Road, north of Seneca St. R. G. Parsons, Secy. Dept. Pub. Wks.

BUFFALO, N. Y.—Bids are asked until July 24 for the trench excavation and concrete foundation, etc., for the post office building at Buffalo. Wm. M. Aiken, Supervising Arch., Washington, D. C.——Bids are asked until July 26 for constructing a high school building at Masten Park and for a 16-room school building on Mineral Spring Road near Seneca St., and for constructing an engine house on Johnson St., near Broadway. R. G. Parsons, Secy. Dept. Pub. Wks.——J. V. Kent has completed plans for a five-story marble, brick and steel business block, for Willis O. Chapin, at 674 Main St., to cost about $75,000.

COHOES, N. Y.—Bids are asked until July 29 for constructing a city hall and station house and jail buildings. Archs., J. C. Holland & Co., Topeka, Kan.; H. C. Fruchting, Pres. Com.; R. S. Clark, Clk. Com.

NEW YORK, N. Y.—W. Wheeler Smith, 7 Wall St., has secured a loan of $1,200,000 from Kuhn, Loeb & Co., on a mortgage on the property at Wall and New Sts. extending through to Broadway. Plans have been prepared by Mr. Smith for a 16-story office building, on which it is proposed to begin work in May, 1896. Benj. D. Silliman, of Brooklyn, and R. W. Gibson, are interested.——The Central Real Estate Association is about to erect a 12-story building at Fourth Ave. and 19th St. at an estimated cost of about $750,000.——Plans have been filed by the Standard Oil Co. for brick buildings at 24 to 30 Broadway and 73 to 79 West St., to cost $500,000; by the Trinity Church Corporation for an eight-story brick warehouse at Varick and Spring Sts., to cost $160,000; by the Young Men's Christian Association, 90 Park Ave., for a six-story brick club house at 317 to 321 West 56th St., to cost $150,000; by John Davis, 506 West 162nd St., for seven three-story brick dwellings on 150th St., to cost $126,000.

ROCHESTER, N. Y.—Bids are asked until July 26 for erecting a fire enginehouse on Genesee St. T. J. Neville, Clk. Bd.

PITTSBURG, PA.—Geo. B. Post has prepared plans for a 15-story office building at Fifth Ave. and Smithfield St. for Park Bros., estimated to cost $500,000.——The trustees of the First Presbyterian Church are considering the question of erecting a 10-story office building, 150 × 28 ft., at Sixth Ave. and Wood St.

PITTSBURG, PA.—D. H. Burnham, of Chicago, has prepared plans for a 12-story hotel on Penn Ave., between Fifth and Sixth Sts. The building will be 260 × 60 ft., and is estimated to cost about $500,000. John Walker and Henry Phipps, Jr., of the Carnegie Steel Co., are interested.——The Pittsburg Armory & Auditorium Association proposes to build an armory, with a seating capacity of about 12,000, and at an estimated cost of $250,000, on the Bedford Ave. reservoir site. Capt. Hunt is interested.

POTTSVILLE, PA.—Plans have been prepared for an additional hospital building at the almshouse, estimated to cost about $70,000, by order of the county commissioners.

SCRANTON, PA.—Beyer & Rantert, Garden City Block, Chicago, have prepared plans for a brewery of 30,000 bbls. capacity for the Consumers' Brewing Co., to cost about $60,000.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 20 for constructing a fire engine house at 1410 D St., and until July 22 for constructing a new ward at the Washington Asylum.

NASHVILLE, TENN.—Plans are asked by the board of prison commissioners until Aug. 1 for a new penitentiary, etc., for the custody of 820 convicts, the cost not to exceed $300,000. Address W. M. Nixon, Chattanooga, Tenn.

COOKEVILLE, TENN.—Bids are asked until July 25 for erecting a jail building to contain about 15 steel cells. A. W. Boyd, County Comr.

LOUISVILLE, KY.—Bids are asked by the board of public safety until Aug. 1 for erecting two engine houses and one combined engine and station house. Charles Kremer, Jr., Secy. Bd.

CINCINNATI, O.—The Pittsburg, Cincinnati & St. Louis Ry. Co. is considering the question of erecting a new five-story freight station, 20 × 50 ft., at the Public Landing.

CLEVELAND, O.—Prof. John Eisemann has prepared plans for a new eight-story city hall, to be erected in the Public Square.

TOLEDO, O.—Plans are asked by the board of education until July 20 for a high school building.——Churchill & Coon are preparing plans for a new grain elevator, to cost $150,000, in East Toledo, near the Lake Shore tracks. The building will have steel tank bins of 1,000,000 bushels capacity.

DETROIT, MICH.—Bids are asked until July 27 for the sale of land to contain not less than 60,000 sq. ft. and within a distance of half a mile from the city hall for a proposed county court house. Wm. H. Hoyt, Chn. Com.; H. M. Reynolds, Clk. Wayne County.

DETROIT, MICH.—Bids are asked until July 30 for constructing a mailing platform and an inclosure for the court house, postoffice, etc., building. Wm. M. Aiken, Supervising Arch., Washington, D. C.——Bids are asked until Aug. 1 for constructing the buoy shed, platform, tramway and derrick for the lighthouse station at St. Joseph, Mich. Maj. M. B. Adams, Lighthouse Engr., U. S. Army.

MADISON, WIS.—Plans are asked until Sept. 14 for a library and museum building for the state historical society of Wisconsin. I. S. Bradley, Secy. Bd.

TOPEKA, KAN.—Bids are asked by the state board of public works until July 24 for building cottages and making improvements at the Soldiers' Orphans' Home at Atchison, at an estimated cost of $60,000; also by the executive council until Aug. 5 for the remaining work for completing the state house. State Arch., J. C. Holland.

HOUSTON, TEX.—Bids are asked until Aug. 3 for constructing a jail building in Jackson county, the bidder to furnish plans, etc. H. L. White, County Judge.

## WATER-WORKS.

BIDDEFORD, ME.—The water company closed a contract July 9 with the Cumberland Mfg. Co., of Boston, for a 3,000,000-gallon filter plant.

KENNEBUNKPORT, ME.—The town has voted, 117 to 98, against accepting a proposition of the Mousam Water Co. to put in works, the company to furnish 30 hydrants for 20 years at $1,000 a year. A similar proposition was recently accepted by Kennebunk.

SOUTH WEST HARBOR, ME.—It is reported that works are being put in by a private company, the water supply being from an artesian well. Pres., Dr. J. D. Phillips.

SUNCOOK, N. H.—J. A. Farrington and L. E. Scruton, of Portsmouth, have made surveys for a water supply from a pond in Allentown. It is stated that Frank Jones, of Portsmouth, N. H., owner of the present works, will spend $50,000 for a complete system.

WILLIMANSETT, MASS.—It is reported that a 12-in. main will be laid from the stand-pipe to the reservoir, at a cost of about $3,000.

WATERBURY, CONN.—Bids are asked until July 23 for cleaning a part of the basin of the Wigwam reservoir, as stated in our advertising columns. R. A. Cairns, Cy. Engr.——The council is reported to have sold $200,000 of 16-year 4% water bonds to W. J. Hayes & Sons, of Boston, for $208,540.

BALLSTON SPA, N. Y.—At the special election July 11, noted last week, the city voted 99 for and 58 against the water-works proposition.

BUFFALO, N. Y.—Bids are asked by the department of public works until July 27 for a 30,000,000-gallon vertical triple-expansion pumping engine.——The board of public works has recommended to the supervisors that a 1,000,000-gallon reservoir be constructed at once at the Almshouse. Geo. A. Davis, Chn. Supervisors.

CLYDE, N. Y.—The Clyde Water Supply Co. has awarded a contract for new hydrants and laying new mains to James Bruff, of Rochester.

CROMWELL-ON-HUDSON, N. Y.—Contracts for works have been awarded as follows: Pipe and castings, to M. J. Drummond, of New York; valves and hydrants, to the Ludlow Valve Co., Troy, N. Y.; reservoir and pipe-

laying, to Thos. McCormick, of Sing Sing, N. Y. It is stated that the latter contract amounted to $31,583. Some of the bids will be published in a later issue. Engr., Alexander Potter, New York.

LOCKPORT, N. Y.—The city clerk has been directed to advertise for bids for a water main in Charlotte St., between Transit and Hawley Sts.

MIDDLEVILLE, N. Y.—Bids are asked until Aug. 8 for the construction of works, as stated in our advertising columns. Munson Nichols, Engr. in Charge; Wm. H. Dickins, Secy. Comrs.

OLEAN, N. Y.—An election will be held in North Olean July 24 to vote on an issue of $19,000 in bonds for works. M. F. Shea, Pres.; Daniel Murphy, Secy.; J. H. Kane, Treas. Comrs.

PERRY, N. Y.—The citizens have voted in favor of the proposed works, noted last week.

PHILMONT, N. Y.—C. N. Harder writes us that the question of works is being investigated, but the committee is not yet ready for bids.

PRATTSVILLE, N. Y.—The village trustees have offered to renew the contract with the water company if the plant is improved and a reservoir built.

RED HOOK, N. Y.—H. Proseus, Secy. Comrs., writes us that the contract for works has been awarded to Van De Bogart & Hains. A large number of bids were received for materials, and also bids for a stand-pipe, the other bids being as follows:

| Items. | W. T. O'Connor & Co., Syracuse, N. Y. | Van De Bogart & Hains, Red Hook. | G. G. Harter, Herkimer, N. Y. | Smith Bros., Pelhamville, N. Y. | Wild Engineering Co., Valatie. | Hendricks, Taylor & Warren, Northampton, Mass. |
|---|---|---|---|---|---|---|
| Systems: | | | | | | |
| Gravity | $31,500 | $31,500 | $32,793 | $51,530 | $32,000 | $31,284 |
| Stand-pipe | 21,036 | 22,404 | 21,275 | 26,137 | 22,750 | 26,672 |
| Pump house | 1,000 | 1,000 | 2,400 | 4,000 | 3,000 | 3,000 |
| *Hydrants | 1,365 | 1,293 | 1,458 | 1,270 | 1,450 | 1,186 |
| Trnch'g and well | 5,355 | 6,495 | 5,125 | 5,038 | .... | 6,063 |
| Pipes, pmp. sys. | 7,861 | 7,857 | 7,576 | 7,789 | 7,600 | 7,917 |

* Valves and boxes.

ROCHESTER, N. Y.—Bids are asked until July 26 for laying cast iron water pipes in 32 streets. Thos. J. Neville, Clk. Executive Bd.

ROCKVILLE CENTER, N. Y.—The contract for constructing works, as advertised in Engineering News, has been awarded to L. J. Richardson, Owego, N. Y., at $25,000, the other bids being as follows: C. A. Lockwood, Jamaica, N. Y., $25,650; William H. Connell, 164 Broadway, New York, $27,375; Mitchell & Co., Newark, N. J., $26,150; George A. Kingsland, 1199 Dean St., Brooklyn, $43,700; Donegan & Swift, 11 Murray St., New York, $29,876; Clark & Co., 186 Remsen St., Brooklyn, $27,250; Momever & Storey Co., 99 John St., New York, $29,380; Bogart & Farrell, 539 Franklin Ave., Brooklyn, $34,250.

ASBURY PARK, N. J.—All the bids for boiler and stack have been rejected and the work will probably be readvertised as soon as new specifications are prepared.

JERSEY CITY, N. J.—Bids are asked by the commissioners until July 23 for a supply of corporation stop cocks, meters, solder and lead. Wm. H. Hooker, Chn. Com.

BUTLER, PA.—The county court has rendered a verdict requiring the Butler Water Co. to furnish pure water to the citizens by Aug. 15.

DUQUESNE, PA.—At a special election July 9 the citizens voted almost unanimously in favor of issuing $75,000 in bonds for works.

EAST BRADY, PA.—R. R. McGregor, Clk., writes us that $10,000 in 4% bonds will be issued for works; supply from artesian wells; population, 1,300; no engineer yet engaged.

EPHRATA, PA.—H. F. Hermes, Clk., writes us that at an election July 9 the citizens voted, 273 to 123, in favor of issuing $30,000 in bonds for works. A press report states that the local works will probably be purchased.

GIRARDVILLE, PA.—Residents of this place are reported about to petition for a supply from Shenandoah, at an estimated cost of $9,000 for the extension.

KNOXVILLE, PA.—The Idlewood Water Co. has been incorporated to operate in Chartiers township, Allegheny county; capital stock, $1,000; Treas., W. D. Grimes.

PAXTANG, PA.—The Paxtang Water Co. has contracted with the Michigan Pipe Co. for a complete pipe system.

BALTIMORE, MD.—Bids are asked until July 24 for 15 tons of Omaha pig lead. Wm. L. Kenly, Acting Ch. Engr.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 31 for completing the Reno reservoir, as stated in our advertising columns.

FORT MYER, VA.—The following bids were received by the depot quartermaster, Washington, for a 30,000-gallon steel water tank and trestle, and for raising the present tank to a corresponding level with the new one:

| | New tank. | Raising old tank. |
|---|---|---|
| I. H. Hathaway & Co., Philadelphia | $4,549 | $969 |
| R. H. Hood, Washington, D. C. | 2,698 | 795 |
| Pittsburg Iron Works Co., Pittsburg | 5,536 | 766 |
| J. Baizley, Philadelphia, Pa. | 4,875 | ... |
| Ellicott Machine Co., Baltimore, Md. | 3,966 | 500 |
| E. J. Codd Co., Baltimore, Md. | 4,993 | ... |

SALEM, W. VA.—Bids will soon be asked for constructing works, according to reports. F. J. Ebret, R. W. Young and G. W. F. Randolph, Commissioners.

EDWARDSVILLE, ALA.—There is talk of constructing works at this place.

ABERDEEN, MISS.—Bids are asked until July 25, according to reports, for a stand-pipe and tower for a town of 4,500 population; also for distributing mains, etc. R. L. Hull, Mayor.

MERIDIAN, MISS.—The council is taking steps to purchase the works, at a reported cost of about $150,000.

JACKSON, TENN.—Bids are asked until Aug. 5 for a 3,000,000-gallon pumping engine. S. C. Lancaster, Cy. Engr.

MORRISTOWN, TENN.—Bids are asked until Aug. 5 for the construction of works, including 6½ miles of pipe, for which $30,000 in bonds have been sold. Engr., J. L. Ludlow, Winston, N. C.; R. F. Taylor, Pres. Comrs.

ELIZABETHTOWN, KY.—Chas T. Warren, Cy. Clk., writes us that plans are about completed for works, and it is probable that materials will be purchased and the construction done by day labor; population, 3,600.

HOPKINSVILLE, KY.—The franchise granted to Jesse W. Starr in January has been annulled, as the construction of works has not yet been commenced. F. W. Dabney, Mayor; H. W. Tibbs, Clk.

CINCINNATI, O.—Bids are asked by the board of administration until July 29 for building the foundations for the Mount Auburn tank.

CLEVELAND, O.—Bids are asked until July 24 for furnishing materials, constructing and delivering four steel boilers, 6 ft. 4 ins. in diameter and 18 ft. long, and until Aug. 7 for removing the old south boiler house chimney, boilers and settings and for the erection of a new boiler house. D. E. Wright, Dir. Pub. Wks.—Bids are asked until Aug. 15 for the purchase of $200,000 in 4% water bonds. H. L. Rossiter, Cy. Audr.

LORAIN, O.—The proposition to issue $125,000 in bonds for improving the works was carried at the special election July 10; also an appropriation of $3,500 for a new jail.

YOUNGSTOWN, O.—We are informed that at an election July 9, the citizens voted, 92% for and 8% against, to issue $160,000 in bonds for extensions of the works, but that no definite plans have yet been agreed upon.

FOWLER, IND.—Bids are asked until July 27 for constructing works, as stated in our advertising columns. Chas. S. Craw, Clk.

TERRE HAUTE, IND.—N. W. Harris, owner of the works, is reported to have decided to spend $15,000 for improvements this year.

ALLEGAN, MICH.—The council has appointed a committee to secure estimates for a steam pump for the works.

FLINT, MICH.—Plans have been prepared for new works, to duplicate the plant of the water company; estimated cost, $96,968. H. R. Lovell, Chn. Com.

JACKSON, MICH.—The proposition to issue $50,000 in bonds for extensions and other improvements was defeated July 8 by a vote of 717 to 417.

LAKE ODESSA, MICH.—The city clerk writes us that the feasibility of constructing works has been considered and estimates made, but no definite steps have yet been taken; population, 1,000.

LEWISTON, MICH.—J. H. Pinkerton, Clk., writes us that $3,500 in bonds have been sold, and that the construction of works will probably be commenced within 60 days; supply to be pumped from lake; population, 800; M. J. McCormick, Supervisor.

OWOSSO, MICH.—The council has directed that bids be asked for a 300,000-gallon tank, and that immediate steps be taken to secure an increased water supply.

STANDISH, MICH.—The Michigan Pipe Co., of Bay City, Mich., has been awarded the contract for constructing works at this place. The power will be obtained from one of the mills in the village.

BUSHNELL, ILL.—Bids are asked until Aug. 3 for furnishing material and sinking an artesian well, as stated in our advertising columns. O. C. Hicks, Cy. Clk.

CHICAGO, ILL.—Bids are asked until July 22 for a supply of hydrants and stop-valve castings, and until July 24 for making borings in the bed of Lake Michigan for the new intake tunnel, for which work $145,000 has been appropriated. W. D. Kent, Comr. Pub. Wks., has also been authorized to advertise for bids for new pumping engines, boilers, etc., estimated to cost $430,000.

FORREST, ILL.—Bids are asked until July 29 for constructing works, including a 1,500-bbl. steel or cypress tank on a 60-ft. tower, pump, about 5,600 ft. of 6 and 4-in. pipe, 21 hydrants, etc. B. H. Bullard, Village Clk.

FORT SHERIDAN, ILL.—The following bids were received for laying mains at this place, according to reports: Frank Lang, Highland Park, Ill. (awarded contract), $8,219; John Healey, Chicago, $9,913; A. W. Fletcher, Highland Park, $9,814; S. I. Pope Co., Chicago, $10,442; C. & I. Iglehart, Morgan Park, $9,472; Daniel Hardin, Chicago, $10,480; J. M. Hansen, Fort Sheridan, $9,995.

JERSEYVILLE, ILL.—Bids are asked until Aug. 6 for sinking an artesian well. H. A. Shephard, Mayor.

LENA, ILL.—An artesian well is being sunk and plans for works are being made by Fairbanks, Morse & Co., of Chicago.

LINCOLN, ILL.—The Lincoln Water, Light & Power Co. is reported as intending to increase the capacity of the pumping plant by adding another pump of 2,000,000 gallons capacity. A third well will also be built.

LOCKPORT, ILL.—Bids are asked until July 27 for the construction of works. Leon McDonald, Pres. Bd.

MAYWOOD, ILL.—S. H. Donaldson, Jr., Clk., writes us that the following bids were received for a stand-pipe, recently advertised:

Corbett & Stodler, Aurora, Ill. (awarded contr.)..$4,460
C. & I. Iglehart, Morgan Park, Ill. ..... 5,994
James Leonard, 36 Indiana St., Chicago ..... 7,650
Dunn & McGarry, 544 West 15th St., Chicago .... 7,276

MILFORD, ILL.—Harman & Evans, Consult. Engrs., Peoria, Ill., have been engaged to design and superintend the construction of a complete system of works at this place.

MILLSTADT, ILL.—The contract for sinking an artesian well 1,200 ft. deep has been awarded to C. M. Carter, at $1,190, according to reports.

SPRING VALLEY, ILL.—An acre of land has been purchased as a site for works, and it is stated that plans and specifications will be completed in a few days. The committee has been directed to rush the work as rapidly as possible.

VERMONT, ILL.—A petition signed by 121 persons has been presented to the town board asking that the artesian well be tested, and that if a sufficient water supply is found that an election be held to vote on the construction of works, estimated to cost $15,000.

VIRGINIA, ILL.—Geo. Conover, R. W. Mills, J. R. Robertson and J. A. Jones are among those reported as interested in the proposed works at this place, noted last week.

BELMONT, WIS.—B. Tredarthen, Village Clk., writes us that the village voted July 10 to issue $3,000 in bonds for works, but that no contracts have yet been awarded; population, 475.

SHAWANO, WIS.—Bids are asked until Aug. 1 for furnishing water-works and electric lights. B. H. Garfield, Chn. Com.

SHULLSBURG, WIS.—The city clerk writes us that Crellin & Lovell, of Des Moines, Ia., have been engaged to prepare plans and specifications, purchase materials and superintend the construction of works.

TOMAHAWK, WIS.—Bids are asked until July 22 for furnishing and laying about 1,818 ft. of 6-in. water pipe. Chas. A. Ayer, Cy. Clk.

WAUWATOSA, WIS.—The village board has decided that steps must be taken at once to secure works. Several schemes are being considered, and if the Milwaukee service is not extended to this place at once it is probable that a supply will be secured from another source.

COLUMBUS JUNCTION, IA.—A resolution has been introduced in the council to hold a special election July 25 to vote again on the question of works.

DOON, IA.—A. N. Thompson, Recdr., writes us that the proposition to issue bonds for works was defeated at the recent election.

ROCKWELL CITY, IA.—Geo. W. Spencer, Cy. Clk., writes us that plans and specifications have not yet been made for the proposed works.

SCHALLER, IA.—Bids are asked until Aug. 5 for constructing works, including a 16×22-ft. pine tank on a 50-ft. wood substructure, 2,194 ft. of 6-in. pipe, 1,378 ft. of 4-in. pipe, 10 hydrants, etc. H. L. Leland, Recdr.

AMBOY, MINN.—L. E. Cross, Recdr., writes us that the following bids were received July 10 for constructing works:

Fairbanks, Morse & Co., St. Paul. ..... $5,280
Jackson & Moss, Ia. (awarded contract). ..... 5,225
Challenge Wind Mill & Feed Mill Co., Batavia, Ill. 5,375
B. Schrieber, Des Moines, Ia. ..... 7,595

BUFFALO, MINN.—An election will soon be held to vote on the construction of works.

MANKATO, MINN.—The proposition to issue $15,000 in bonds for extensions received 518 votes, with 452 votes against it. A two-thirds vote was necessary.

NEW PRAGUE, MINN.—Bids are asked until July 29 for constructing works, including a tower and tank, gasoline engine and 3,200 ft. of 10 to 4-in. pipe, as described in our issue of June 20. John Joach, Cy. Clk.

PLAINVIEW, MINN.—Bids are being received for $10,000 of bonds, according to reports, and it is stated that the construction of works will soon be commenced.

PRINCETON, MINN.—The contract for works has been awarded to Fairbanks, Morse & Co., of St. Paul, at $18,020 for works and an electric light plant.

ALBANY, MO.—Bids are asked for a franchise for works, according to reports. W. M. Millen, Cy. Clk.

GRAND JUNCTION, COLO.—Bids are asked until Aug. 20 for the construction of works, as noted in our advertising columns. C. P. Allen, Ch. Engr., Denver; M. L. Allison, Mayor.

LARAMIE, WYO.—Press reports state that $40,000 in bonds will be issued at once and the construction of works commenced at an early date.

GRANBY, QUE.—The water supply system will be completed this summer by the addition of about four miles of 4-in. pipe within the town limits and repairs to the reservoir. T. S. O'Dwyer, Engr.

## SEWERAGE.

PORTSMOUTH, N. H.—An ordinance has been introduced in the council authorizing an issue of $150,000 in bonds for completing the system.

ARLINGTON, MASS.—This town has voted to construct a system of 10 to 6-in. pipe sewers in the Henderson St. district at an estimated cost of $10,500. Engr., Geo. A. Kimball, 53 State St., Boston; Edward S. Fessenden, Chn. Comrs.

BOSTON, MASS.—Bids are asked until July 22 for constructing 1,540 ft. of 12 and 10-in. pipe sewers, the work including 150 cu. yds. rock excavation. B. T. Wheeler, Supt. Sts.

QUINCY, MASS.—This city has voted to accept the legislative act granting it authority to construct a system, the estimates for which were given in our issue of June 27. Engrs., Noyes & Hazen, of Boston.

WEBSTER, MASS.—L. A. Taylor, of Worcester, and John A. Whitaker, of Webster, have completed surveys for the proposed system.

MERIDEN, CONN.—The committee has directed the immediate construction of seven additional sewage beds at an estimated cost of from $7,000 to $9,000. This work is described in another column of this issue.

WATERBURY, CONN.—Bids are asked by the commissioners until July 31 for constructing sewers in three streets.

ALBANY, N. Y.—Patrick Doyle has been awarded the contract for a sewer in North Pearl St., at $6,140.

BROOKLYN, N. Y.—It is reported that the city works commissioner is preparing plans for a new storm relief sewer to relieve Knickerbocker, Wyckoff and Morgan Aves. It will begin at the intersection of Morgan and Johnson Aves. and be built through Johnson Ave., until it makes a slight curve, discharging surface water into the head of Newtown Creek Canal. The estimated cost is about $150,000.

BUFFALO, N. Y.—The board of public works has received the following bids for the construction of a 6 ft. 6-in. and 5 ft. 3-in. brick sewer from Cazenovia Creek southerly in the center of Meriden St. and the northerly side of the Abbott Road: Elmer Mighton, $53,000; Jacob Ritzman, $53,700; August Glael, $54,500; Henry Harter, $55,026; Christopher Smith, $54,582; G. W. Moore, $62,300; Dodge & McGregor, $62,482; William Franklin, $59,312; George & Thomas Dark, Jr., $56,231; Ryan & Delaney, $41,481; M. McNamara & Son, $108,000.

ITHACA, N. Y.—Bids are asked until July 20 for the

purchase of $150,000 of 4% sewer bonds. R. B. Williams, Chn. Sewer Com; H. M. Hibbard, Treas.

ITHACA, N. Y.—Bids are asked until July 27 for constructing a brick sewage pumping station, with a chimney 70 ft. in height, and for constructing about 12,000 ft. of 36 to 2-in. brick and iron pipe sewers, etc. Roger B. Williams, Chn. Bd. Comrs.; Henry N. Ogden, Ch. Engr.

MECHANICVILLE, N. Y.—An election will be held July 30 to vote on the question of constructing a system, at an estimated cost of $37,000 to $47,000.

NEW BRIGHTON, N. Y.—Plans have been prepared for a joint outlet sewer for this place and Port Richmond in Jewett Ave., Port Richmond. It is probable that the board will soon advertise for bids. Engr., O. T. Barrett.

NIAGARA FALLS, N. Y.—The Cataract Construction Co. has petitioned the board of public works to build a sewer in Buffalo Ave., from the power canal to Gill Creek, to connect with the trunk sewer in 22d St., a distance of about 5,500 ft., estimated to cost $30,000.

ROCHESTER, N. Y.—Bids are asked until July 26 for constructing pipe sewers in two streets. T. J. Neville, Clk. Bd.

SYRACUSE, N. Y.—Bids are asked until July 22 for constructing a 30-in. brick sewer in University Place and 20 to 10-in. pipe sewers. H. F. Stephens, Cy. Clk.; Henry C. Allen, Cy. Engr.

SALAMANCA, N. Y.—The construction of sewers in Elm and Maple Sts. is being considered.

POUGHKEEPSIE, N. Y.—The sewage of Vassar College is to be purified by intermittent filtration, and the college has recently purchased the land to be used for this purpose. Engrs., Noyes & Hazen, Boston.

HACKENSACK, N. J.—Rudolph Hering, of New York, has been engaged to recommend a plan for converting Hackensack Creek into a sewer. Lemuel Lozier, Town Engr.

ORANGE, N. J.—Bids are asked until Aug. 5 for constructing about 2,000 ft. of 7-ft. to 5½-ft. brick sewer and 28,000 ft. of 15 to 8-in. pipe sewers, as stated in our advertising columns. F. T. Crane, Cy. Engr.; Alpheus Struble, Cy. Clk.

PATERSON, N. J.—The aldermen propose to construct 1,650 ft. of 18 and 12-in. pipe sewers. Thomas McLean, Cy. St. Comr.

COLWYN, PA.—Bids are asked until July 24 for constructing sewers. Engr., Enon M. Harris, Jr., Collingdale; address A. P. Hill, Colwyn.

PHILADELPHIA, PA.—Bids are asked until July 22 for the purchase of $964,500 of 3½ sewer, street and improvement bonds. C. F. Warwick, Mayor.

PITTSBURG, PA.—Bids are asked until July 27 for constructing 24 to 15-in. pipe sewers and for 12-ft to 2 ft. 6-in. brick and stone culverts. E. M. Bigelow, Dir. Pub. Wks.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 29 for furnishing bluestone trap frames and covers, sewer pipe, etc., as stated in our advertising columns.

BALTIMORE, MD.—Bids are asked until July 19 for constructing storm sewers in Alluvian, Pressman and Monroe Sts. and Brice Alley. H. T. Douglas, Cy. Comr.

HAGERSTOWN, MD.—The street commissioners have voted to build a sewer 1,010 ft. in length in the west end of the town. Jacob Zeigler, St. Supt.

WHEELING, W. VA.—Bids are asked by the board of public works until July 20 for constructing pipe sewers. W. H. Harnish, Clk.

PADUCAH, KY.—The board of magistrates in the fiscal court is considering the question of constructing sewers.

HAMMOND, IND.—Bids are asked until Aug. 6 for constructing the North Calumet Ave. main sewer. W. F. Bridge, Cy. Engr.

INDIANAPOLIS, IND.—Bids are asked until July 23 for constructing 2,840 ft. of 18 to 6-in. pipe sewers.

INDIANAPOLIS, IND.—Bids are asked by the board of public works until Aug. 13 for constructing 20,882 ft. of 6 ft. 9-in. to 3-ft. circular brick sewer, as stated in our advertising columns. The work is estimated to cost about $130,000. Chas. C. Brown, Cy. Engr.

RICHMOND, IND.—The council is considering the question of constructing a system for part of the city west of Fifth St. and north of Main St. H. L. Weber, Cy. Engr.

GRAND RAPIDS, MICH.—H. A. Collar, Cy. Engr., has recommended the extension down the Grand River of the Island Addition Co.'s private sewer.

CHICAGO, ILL.—W. D. Kent, Comr. Pub. Wks., and G. L. Clausen, Supt. of Sewers, are reported as considering plans for an outlet sewer in the 83d St. district.

GALENA, ILL.—Bids are asked until July 23 for constructing 2,200 ft. of 24 to 20-in. pipe sewers in Main St and for furnishing 2,100 ft. of 24 to 8-in. sewer pipe, etc. John B. French, Cy. Clk.

GROSSDALE, ILL.—Bids are asked until Aug. 1 for constructing sewers in West Grossdale. Engrs., Hill & Enricht, Chamber of Commerce, Chicago; John A. Hahn, Village Clk.

MONTICELLO, ILL.—Bids are asked until July 25 for constructing 12,910 ft. of 12 to 8-in. pipe sewers, as stated in our advertising columns. D. E. Widdersheim, Cy. Clk.

MILWAUKEE, WIS.—The supervisors are considering the question of constructing a sewer system for the Menomonee and the Kinnickinnic valleys. The state board of health last year recommended that the supervisors appropriate $10,000 for making surveys. U. O. B. Wingate, Secy. State Bd. of Health.

DULUTH, MINN.—The board of public works is considering the question of constructing a sewer to connect with the Central Ave. sewer in West Duluth, which now empties into an open creek. It is proposed to then extend the Central Ave. sewer in 53d Ave. to the bay.

MOORHEAD, MINN.—Kinker & Hoff, of Minneapolis, have been awarded the contract for constructing a sewer at $10,300. The other bidders were Charles Perrit, of Fargo, N. Dak., at $10,800, and C. B. Hill, of Moorhead, at $12,510.

ST. LOUIS, MO.—The committee of the board of public improvements has recommended the construction of sewers in about ten streets at an estimated cost of $107,400.

SEATTLE, WASH.—The board of public works has been directed to construct a 30 to 20-in. brick sewer in Remington Ave. at an estimated cost of $21,941. R. F. Stewart, Cy. Clk.

SAN FRANCISCO, CAL.—The construction of a system at the Presidio, at an estimated cost of $30,000, is being considered.

## GARBAGE DISPOSAL.

BRADDOCK, PA.—A press report states that the borough authorities, having been prevented by the United States from dumping the garbage into the river, have decided to locate a dump at Eighth St. and burn the refuse.

## STREETS AND ROADS.

HARTFORD, CONN.—The commissioners are reported about to recommend the paving of Main St. from Arch St. to Needham's Corner with asphalt.

ALBANY, N. Y.—Horace Andrews, Cy. Engr., has been directed to advertise for bids for paving two streets with brick.—Peter Calaman has been awarded the contract for paving State St. at $5,884.

COHOES, N. Y.—The committee has recommended that 1,000 lin. ft. of Saratoga St. be paved.

FLUSHING, N. Y.—The question of appropriating $50,000 for macadamizing the roads is being considered, according to reports.

GLENS FALLS, N. Y.—We are informed that this place is considering the question of brick or asphalt paving. Address D. F. Keeffe, Glens Falls.

NEW YORK, N. Y.—Bids are asked until July 29 for paving portions of ten streets with asphalt on the present granite blocks. William Brookfield, Comr. Pub. Wks.

RICHMOND HILL, N. Y.—It is reported that an election was called for July 15 to vote on issuing $40,000 of bonds for street improvements, $8,000 for a city hall, etc.

STAPLETON, N. Y.—Contracts will soon be awarded for macadamizing Henderson Ave., in Castleton, and the Old Stone road in Northfield. Engr., Henry P. Morrison.—The following contracts were awarded July 15 by the supervisors for road work in Richmond county: Thomas, Redbing, 224 High St., Perth Amboy, N. J., $30,862; Bernard Mahon, 2293 Seventh Ave., New York, $4,444; Donovan Bros., Port Richmond, S. I., $5,669; Joseph Johnson, West New Brighton, S. I., $8,928, $11,276, $14,134, and Bernard Mahon, $4,558. The itemized bids for some of this work will be published in a later issue.

WATERTOWN, N. Y.—The council is considering the question of readvertising for bids for asphalt paving.

YONKERS, N. Y.—Pennell & O'Hern have been awarded the contract for grading Valentine Lane at $17,611, and Byron & Flannagan the contract for grading Jerome Ave., at $12,500.

HOBOKEN, N. J.—The council has voted to advertise for bids for paving portions of seven streets with asphalt. This is reported as the first step towards an extensive system of asphalt paved streets.

JERSEY CITY, N. J.—Bids are asked until July 23 for about 10,800 sq. yds. of asphalt paving, with 2,500 cu. yds. of rock and earth excavation, etc., and until July 30 for 10,000 sq. yds. of asphalt paving on cobblestones and Belgian blocks; for 4,500 sq. yds. of brick paving, and for 34,300 sq. yds. of Belgian block paving and repaving. John C. Kaiser, Chn. Com.; D. W. Startup, Clk. Pro Tem. Comrs.

KEARNY, N. J.—Bids are asked until July 23 for curbing and improving Kearny Ave. Young & Borrie, Surveyors, Broad St., Newark. G. B. Reid, Township Clk.

NEWARK, N. J.—Bids are asked for 22,500 sq. yds. of granite block paving, 66,000 sq. yds. of sheet asphalt paving, 13,000 sq. yds. of trap rock block paving, 1,320 ft. of 12 to 8-in. pipe sewers, etc. J. C. Mundy, Gen. Supt. of Works.

ALLEGHENY, PA.—David Park, Thomas M. Marshall, Jr., Josiah Davidson, of the First National Bank, and others, are interested in a company that is reported about to extend Perrysville Ave. for a distance of six miles, at an estimated cost of about $200,000, making the boulevard 11 miles in length. The city is making a number of improvements on the avenue, including asphalt paving, at an estimated cost of $350,000.

NEW CASTLE, PA.—Bids are asked until July 31 for paving Pittsburg St. with brick. Frank Tidball, Cy. Clk.

BALTIMORE, MD.—Bids are asked until July 22 for furnishing the Baltimore & Fredericktown Turnpike Road Co. with 3,500 perch of broken stone. Supt., Allen Dorsey.

WHEELING, W. VA.—Bids are asked until July 20 for paving streets and alleys with vitrified brick. W. H. Hornish, Clk. Bd. Pub. Wks.

CHATTANOOGA, TENN.—The board of public works has voted to spend $40,000 in paving the streets this year.

LOUISVILLE, KY.—Bids are asked until July 26 for paving portions of four streets with granite blocks, 13 streets with brick, two with artificial stone, and for constructing a sewer in 28th St. J. Henry Hoertz, Secy. Bd. Pub. Wks.

CINCINNATI, O.—Bids are asked until Aug. 3 for paving East Court St. with brick. A. P. Butterfield, Clk. Bd. Administration.

CLEVELAND, O.—Bids are asked by the board of park commissioners until July 24 for grading and improving a portion of Ambler Parkway in and adjacent to the city. Ch. Engr., C. W. Pratt, Jr., Hickox Bldg.

EVANSTON, O.—Bids are asked until July 27 for improving Clarion Ave. Engr., Chas. A. Ewing; Wm. H. Krapp, Clk.

MANSFIELD, O.—Bids are asked until Aug. 3 for 14,000 sq. yds. of brick or asphalt paving, as stated in our advertising columns. J. B. Weddell, Cy. Engr.

TOLEDO, O.—Bids are asked until Aug. 7 for the purchase of $17,084 of 5% and 4½% street improvement bonds. M. S. Wright, Cy. Audr.

INDIANAPOLIS, IND.—Bids are asked until July 23 for 12,220 sq. yds. of asphalt and 2,000 sq. yds. of brick paving, and until July 25 for 40,740 sq. yds. of macadam paving, etc.—Resolutions have been adopted for about 13,000 lin. ft. of asphalt paving, about 17,500 lin. ft. of cement sidewalks, etc. Chas. C. Brown, Cy. Engr.

RICHMOND, IND.—Bids are asked until Aug. 2 for 2,300 lin. ft. of stone curbing and brick gutters, 1,300 lin. ft. of macadam road, and 1,800 ft. of pipe sewers. H. L. Weber, Cy. Engr.

WABASH, IND.—Bids are asked until July 22 for macadamizing and improving Halliday St. Howe McGuire, Cy. Clk.

MONROE, MICH.—Bids are asked until July 29 for paving Front St. with brick. John Steiner, Cy. Clk.

GROSSDALE, ILL.—Bids are asked until Aug. 1 for grading and macadamizing portions of nine streets. Engrs., Hill & Enricht, Chicago; J. A. Hahn, Village Clk.

PONTIAC, ILL.—Bids are asked until Aug. 15 for grading, laying 3,864 lin. ft. of curbing and 11,812 sq. yds. of brick pavement, as stated in our advertising columns. W. J. Butler, Cy. Clk.

SPRINGFIELD, ILL.—Bids are asked until Aug. 10 for paving portions of nine streets. W. H. Hinricksen, Secy. of State.

ST. LOUIS, MO.—The board of public improvements has passed ordinances for improving portions of about 10 streets and for constructing sewers in eight streets.

FARGO, N. DAK.—Bids are asked by the council until July 24 for paving Front St. with Norway pine.

DENVER, COLO.—The board of public works proposes to pave Court Place with asphalt, at an estimated cost of $24,568. E. Monah, Pres.

## MANUFACTURING PLANTS.

FAIR HAVEN, VT.—The Evergreen Slate Mills, three miles east of this place, are reported to have been totally destroyed by fire; loss, $15,000. The mill will probably be rebuilt.

NORTH ADAMS, MASS.—The Windsor Print Works is reported to have closed a contract with Potter & Hanum to build an addition to the works on Union St., two stories, 115 × 70 ft. New machinery will be added. Work will be begun as soon as possible.

WHITINSVILLE, MASS.—A press report states that a large addition is to be built to the Paul Whitin Mfg. Co.'s plant at Northbridge. The new building will be of brick, 200 × 100 ft., four stories. Seven hundred looms will be placed in the addition, making a total of 1,600. The estimated cost of the improvement is $250,000. Fifty new tenements will be built at Northbridge, and 500 additional operatives will be employed.

MAYVILLE, N. Y.—The old Hunt farm, just north of the Chautauqua Assembly Grounds, is said to have been sold to an English brewing syndicate, which will build a large brewery on the property.

TROY, N. Y.—The Quandt Brewing Co. is contemplating extensive improvements to its plant on River St. this fall, at an estimated cost of $40,000.

UTICA, N. Y.—A meeting of those interested in starting a new knitting mill in the Bayliss factory on Broad St. has been held at the Utica City National Bank. The manufacturers interested include Frisbie & Stansfield, of Camden, who manufacture ladies and children's underwear. The concern will employ about 200 hands. The company will organize with a capital stock of $75,000.

PATERSON, N. J.—The Bamford Mfg. Co. is erecting a new engine and boiler house at its Cliff St. mills and will put in a new Corliss engine and two new boilers.

ALLENTOWN, PA.—It is reported that F. F. Schneck & Son will erect a three-story brick furniture factory, 50 × 91 ft., with a two-story L annex, on south side of North St., between 10th and 11th Sts.

CARLISLE, PA.—The Lindner Shoe Co., of this city, has decided to enlarge its plant by building an 82 × 32-ft. addition.

COLUMBIA, PA.—It is reported that the work of constructing the Susquehanna rolling mill, which was burned some time ago, will be commenced this week.

OIL CITY, PA.—The Oil City Furniture & Desk Factory is reported to have been entirely destroyed by fire; loss, $20,000; insurance, $8,000.

PHILADELPHIA, PA.—George L. Phipps, Arch., is reported at work on plans for a 78 × 36-ft. pump and tank house for the Delaware Paper Mills, at Richmond and Tioga Sts.

ROANOKE, VA.—It is understood that the Roanoke Improvement & Power Co. will award the contract at Roanoke Rapids, a few miles from Wedon, for the rebuilding of a large mill at that place, to cost about $75,000.

WHEELING, W. VA.—It is reported that George K. McMechen & Sons Co. will erect a new plant, consisting of building four stories high, 50 × 100 ft., at 28th and Main Sts. Archs., Franzheim, Giesy & Faris. J. A. Holiday has the contract for the building.

HILLSBORO, N. C.—It is proposed to build and equip a cotton mill at this place, to cost $60,000 or $75,000, and a company is now forming for that purpose. Joseph A. Harris can be applied to for particulars.

MAYO, N. C.—A company with a capital stock of $300,000 has been incorporated under the name of the Mayo Falls Cotton Mills Co., for the purpose of building and equipping a large cotton mill in Rockingham county, N. C., at the new town of Mayodon. The principal stockholders are J. H. Fries, Salem, N. C., and Washington Duke and G. W. Watts, Durham, N. C.

RALEIGH, N. C.—A press report from this city states as follows: Three new cotton mills have just been contracted for in North Carolina, one at Weldon, with 12,000 spindles, which are to be increased to 30,000; one at Maysden, with 15,000 spindles, to be increased to 60,000; and one at Hillsborough, with 6,000 spindles. Work is now progressing on twelve mills, and additions are being made to the equipment of as many more. Work began July 15 on a 12,000-spindle cotton mill at the town of Concord.

WELDON, N. C.—A four-story, 254 × 106-ft. cotton mill building is to be built at this place and equipped with the most modern machinery. The contract for the building has been awarded to W. A. Chesterman & Co., of Richmond, Va. None of the engines, machinery, etc., have yet been contracted for. Brown & Garger, of Washington, D. C., are building a knitting mill also at this place.

LANCASTER, S. C.—An organization was perfected at this place during the past week for the purpose of building and equipping a cotton mill, to cost about $100,000, and $76,000 of the capital stock was subscribed at once. The following officers have been elected: Pres., Le Roy Springs, of Charlotte, N. C.; Secy. and Treas., Waddy C. Thompson; directors, H. S. Chadwick, Charlotte; R. E. Wylie, J. M. Heath, W. T. Gregory, Ira B. Jones, Ernest Moore, Wm. Ganson, any of whom can be applied to for particulars.

UNION, S. C.—The Union Cotton Mills Co., at this place, has increased its capital stock from $125,000 to $200,000, and will make some important improvements in both buildings and equipment. Address the secretary.

STONEWALL STATION, MISS.—A press report states that at the last meeting of the stockholders of the Stonewall Cotton Mills, located at Stonewall, Clarke county, it was decided to increase the capital stock of the company $200,000, for the purpose of constructing another mill, to be known as Mill No. 2. Pres., Dr. O. F. Cawthorn, Mobile, Ala.; Secy., T. L. Wainwright, of Stonewall.

YOUNGSTOWN, O.—The Brown-Bonnell Iron Co. is reported as to spend $50,000 on improvements at the Struthers furnace, and as to build a steel plant at Youngstown.

DETROIT, MICH.—J. L. Gearing & Sons, 917 Hammond Bldg., are reported about to erect a two-story brick and stone planing mill on Warren Ave. Arch., J. V. Gearing, 971 Hammond Bldg.

BAY CITY, MICH.—The National Cycle Mfg. Co. of this city is to erect a brick addition 112 ft. long by 40 ft. wide to its main building, and a boiler room 30 × 30 ft., all two stories high.

DENVER, COLO.—The George W. Bowman Motor Road Carriage Co. is reported to have been organized to manufacture patented road vehicles; capital stock, $100,000; incorporators, George Wirt Bowman, Edward N. Dravo, Albert E. Hinton and others.

000 is available for the wall and $39,970 for the building work. Address E. O. Matthews, Ch. of Bureau of Yards and Docks, Washington.

SMOKE PREVENTING DEVICE.—Cleveland, O.—The following bids were received July 8 for equipping the West Side pumping station with smoke-preventing devices:

| | Equip'g 6 boilers. Tubular. | Marine. |
|---|---|---|
| Playford Stoker Co., Cleveland | $4,187 | $6,587 |
| Hawley Down-Draft Co., Chicago | 6,400 | ..... |
| Murphy Iron Works Co., Detroit | 7,815 | 9,920 |
| Chafer & Becker, Cleveland | 5,000 | 6,000 |
| American Stoker Co., Dayton | 7,200 | 9,000 |

IRON PIPE AND STEEL RAILS.—Ithaca, N. Y.—Bids are asked until July 27 for furnishing about 182 tons of 14-in. cast iron pipe and 130 tons of old 40 or 60-lb. steel rails, as stated in our advertising columns. Burns & Banks, Ithaca. (This firm has just been awarded the contract for constructing an outfall sewer, as noted under Contract Prices.—Ed.)

FORT IMPROVEMENTS.—San Francisco, Cal.—The "Call" states that the following work is contemplated at the Presidio by the War Department:

| | Estimated cost. |
|---|---|
| Seven double barracks, $40,000 each | $280,000 |
| Twenty brick and stone buildings for officers | 100,000 |
| Six brick and stone stables | 30,000 |
| Water-works plant (completed) | 20,000 |
| Tree planting | 15,000 |
| Road improvements (under way) | 6,000 |
| Fences and gates | 10,000 |
| Parade ground | 10,000 |
| Sewerage system | 30,000 |
| Total | $511,000 |

CANAL IMPROVEMENTS.—Albany, N. Y.—Bids are asked until July 23 for culvert and vertical wall on second level of Cayuga and Seneca Canal at Seneca Falls and for removing the bulkhead near the Silby Peter T. Mulligan, city, $1.64 per ft. complete; Peter Stipp, city, $1.80 per ft. complete; Hart & Gibbons, Wilkes Barre, $1.38 per ft. complete.

ASPHALT PAVING, ETC.—Indianapolis, Ind.—Contracts have been let for asphalt on Buchannan St., 2,100 × 24 ft., 6,161 sq. yds., 4 ins. Portland cement concrete, 4,135 ft. curb, 201 ft. granite round corner, 201 ft. marginal stone, 3 catchbasins, 20 inlets, 112 ft. 15-in. pipe, to the Indiana Bermudez Asphalt Co. at $3.69 a lin. ft. of each side of the street; other bids being $3.80 and $3.86; also for cement sidewalk on State St., 2,595 ft. × 6 ft., 14,109 sq. ft. of cement and 244 lin. ft. of stone crossing, to W. H. Peters at 67 cts. a lin. ft., other bids ranging from 68 cts. to 80 cts.; also for cement sidewalk on First St., 5,055 ft. × 4.5 ft., with 20,687 sq. ft. of cement and 458 lin. ft. of stone crossings, to W. H. Peters at 51 cts. a lin. ft., other bids ranging from 51 to 62 cts.; also a brick sidewalk on State St., 1,730 ft. × 6 ft., to F. W. Nolting at 34.5 cts. a lin. ft.

WATER-WORKS.—Wenona, Ill.—Geo. C. Morgan, Engr., Chicago, writes us that contracts for works, for which bids were opened July 11, have been awarded as follows: Addyston Pipe & Steel Co., Cincinnati, 8-in. pipe, $22.90 a ton; 6-in. and 4-in., $23.90; special castings, 2½ cts. a lb. Crane Co., Chicago, hydrants, $22.50 each. Rensselaer Mfg. Co., Troy, N. Y., 8-in. valves, $17.50 each; 6-in., $11.40; 4-in., $7; boxes, $2.75 each; all materials to be delivered f. o. b. cars Wenona. C. & T. Iglehart, Morgan Park, Ill., laying 4-in. pipe, 10.9 cts. a lin. ft.; 6-in., 12.9 cts.; 8-in., 17 cts.

BITUMINOUS PAVING.—San Francisco, Cal.—Contracts aggregating about $75,000 have been awarded to the City Improvement Co. for paving with bituminous rock, at 14 cts. per sq. ft.

RESERVOIR.—New York, N. Y.—The following bids were opened by the aqueduct commissioners July 10 for building the Jerome Park reservoir, to have a capacity of 2,000,000,000 gallons; work is described more fully in another column of this issue; A. Fteley, Ch. Engr.; Edward L. Allen, Secy. Comrs.

BIDS RECEIVED BY THE AQUEDUCT COMMISSIONERS, NEW YORK CITY, JULY 10, 1895, FOR CONSTRUCTING THE JEROME PARK RESERVOIR.

| | Quantities. | Engineer's estimate, $5,882,600. | Calvin E. Brodhead, Edgewater, N.J., $10,773,470. | Stratford & Hawkes, Brooklyn, N. Y., $7,116,930. | Smith, Mason & Co., Chicago, Ill., $6,722,295. | J. S. & D. D. Casement & Co., Painesville, O., $6,067,448. | Andrew Onderdonk, New York, $5,492,629. | Jno. R. McDonald, Baltimore, Md., $5,473,000. | T. E. Crimmins, J. W. Hoffman & Co. and Ira A. Shaler, New York, $7,656,180. | Washburn & Washburn, New York, $5,879,948. | Jno. B. Westbrook, 140 Nassau St., N. Y., $6,086,110. | John O'Brien, New York, $5,257,370. | Jas. D. Leary, 22 State St., N. Y., $9,450,150. | Isaac A. Hopper, 215 W. 126th St., N. Y., $7,232,627. | Henry H. Brown, 2867 8th Ave., N.Y., $6,442,250. | Clinton Stephens, Yonkers, N.Y., $6,763,700. | R. A. Malone, Sons & Co., Lancaster, Pa., $5,621,182. | Ryan, Drake, McMullen & Rodgers, N. Y., $5,732,175. | J. P. Cranford & Sons, 16 Court St., Brooklyn, $6,105,440. | B. F. Coleman, 38 E. 69th St., N. Y., $13,368,200. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | Soil, excavated and placed | 11,000 cu. yds. | $ 25 | 40.40 | $0.25 | $0.325 | $0.25 | $0.25 | $0.25 | $0.40 | $0.75 | $0.50 | $0.40 | $0.40 | $0.34 | $0.40 | $0.25 | $0.35 | $0.25 | $0.20 | $0.50 |
| aa | Sodding | 52,000 sq. yds. | .60 | .35 | .30 | .35 | .30 | .15 | .15 | .35 | .25 | .11 | .25 | .40 | .17 | .25 | .25 | .25 | .20 | .15 | .50 |
| b | Earth excavation for aqueduct | 85,000 cu. yds. | .35 | .40 | .20 | .30 | .40 | .30 | .25 | .45 | .62 | .60 | .30 | .70 | .46 | .25 | .50 | .28 | .50 | .35 | 1.50 |
| bb | " " " reservoir | 3,730,000 " " | .28 | .75 | .40 | .41 | .2725 | .21 | .235 | .40 | .30 | .28 | .30 | .54 | .37 | .34 | .44 | .30 | .25 | .30 | 1.50 |
| c | Rock excavation for aqueduct | 23,000 " " | 1.50 | 1.35 | 2.00 | 1.00 | 1.75 | 2.00 | 1.50 | 1.75 | 2.50 | 1.50 | .75 | 1.70 | 1.50 | 1.10 | 2.00 | 1.00 | 2.00 | 1.50 | 3.00 |
| cc | " " " reservoir | 3,165,000 " " | .92 | 1.75 | 1.10 | .98 | .9125 | .83 | .86 | 1.25 | .83 | .90 | .75 | 1.60 | 1.25 | 1.00 | .90 | .80 | .935 | .93 | 1.50 |
| ccc | [1]Haul'g earth and rock excav. | 10,000 " " | .... | .016 | .008 | .012 | .016 | .012 | .01 | .018 | .0248 | .024 | .012 | .028 | .0184 | .01 | .02 | .0112 | .02 | .014 | .06 |
| d | [2]Squares prepared for concrete | 50,000 squares. | 1.10 | 2.50 | 4.00 | 1.00 | .50 | 1.25 | 1.00 | 1.00 | 2.25 | 1.00 | .50 | 2.00 | 2.30 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.50 |
| e | Permanent timber work | 20 M. ft. | 30.00 | 40.00 | 30.00 | 35.00 | 30.00 | 35.00 | 50.00 | 40.00 | 30.00 | 30.00 | 40.00 | 50.00 | 40.00 | 50.00 | 50.00 | 50.00 | 50.00 | 25.00 | 40.00 |
| ee | Per. timbr. wk., grovd and tongd. | 10 " " | 40.00 | 50.00 | 40.00 | 45.00 | 60.00 | 45.00 | 65.00 | 45.00 | 40.00 | 40.00 | 50.00 | 60.00 | 45.00 | 55.00 | 60.00 | 50.00 | 55.00 | 30.00 | 45.00 |
| f | Portland cement | 1,000 bbls. | 3.00 | 3.00 | 3.00 | 2.90 | 3.00 | 2.30 | 3.00 | 3.00 | 2.50 | 2.50 | 3.00 | 3.00 | 2.53 | 3.00 | 3.00 | 2.50 | 2.75 | 3.00 | 3.00 |
| g | Concrete (4 to 1) thk. 4 ins. or less | 45,000 cu. yds. | 5.00 | 6.50 | 6.00 | 6.75 | 5.50 | 6.00 | 4.80 | 5.00 | 4.75 | 5.25 | 4.50 | 6.30 | 5.17 | 5.25 | 5.00 | 5.00 | 4.75 | 4.80 | 7.00 |
| gg | " " " over 4 ins. | 90,000 " " | 4.50 | 6.25 | 5.00 | 6.25 | 5.39 | 5.50 | 4.60 | 5.50 | 4.75 | 5.00 | 4.60 | 6.00 | 5.17 | 5.00 | 5.00 | 5.00 | 4.50 | 4.70 | 6.50 |
| ggg | Concrete (5 to 1) | 16,000 " " | 4.00 | 6.00 | 4.25 | 5.00 | 4.50 | 3.50 | 3.75 | 5.00 | 3.50 | 4.00 | 4.00 | 4.50 | 2.90 | 4.50 | 4.00 | 4.00 | 3.50 | 3.00 | 4.75 |
| h | Brick masonry | 35,000 " " | 9.00 | 9.50 | 7.50 | 8.60 | 10.00 | 8.00 | 10.00 | 13.00 | 10.50 | 10.00 | 9.00 | 10.00 | 7.76 | 9.00 | 11.00 | 9.00 | 9.50 | 9.75 | 12.00 |
| hh | Brick masonry (laid on edge) | 47,000 sq. " | 1.25 | 1.25 | .85 | 1.00 | 1.50 | 1.00 | 1.00 | 1.25 | 1.00 | 1.50 | 1.00 | 1.10 | .92 | 1.00 | 1.00 | 1.30 | 1.00 | 1.25 | 2.50 |
| k | Rubble masonry | 113,000 cu. " | 3.75 | 4.45 | 3.75 | 3.25 | 3.50 | 3.50 | 3.20 | 3.50 | 3.00 | 4.00 | 3.50 | 4.00 | 2.47 | 4.00 | 5.00 | 3.90 | 3.25 | 4.00 | 4.50 |
| l | Dry rubble masonry | 17,000 " " | 2.00 | 2.75 | 3.00 | 2.50 | 6.00 | 2.00 | 2.50 | 3.00 | 3.00 | 2.00 | 2.30 | 3.00 | 1.55 | 2.50 | 2.75 | 2.50 | 2.00 | 7.00 | 2.50 |
| m | Riprap | 1,000 " " | 1.50 | 1.00 | 2.50 | 1.25 | 2.00 | 1.50 | 1.50 | 2.50 | .65 | 1.00 | 2.00 | 1.50 | 1.56 | 2.00 | 2.00 | 1.00 | 1.50 | 1.00 | 1.25 |
| n | Broken stone | 13,000 " " | 1.50 | 2.50 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 3.00 | 2.50 | 1.00 | 1.00 | 2.00 | 2.30 | 1.90 | 2.50 | 1.50 | 1.50 | 2.20 | 2.25 |
| o | Granite dimension stone masonry | 1,000 " " | 35.00 | 37.50 | 60.00 | 40.00 | 40.00 | 45.00 | 35.00 | 35.00 | 40.00 | 50.00 | 30.00 | 38.00 | 31.00 | 35.00 | 50.00 | 30.00 | 30.00 | 35.00 | 40.00 |
| p | Face work for rubble masonry | 250,000 sq. ft. | .25 | .38 | .20 | .30 | .50 | .60 | .25 | .30 | .70 | .70 | .25 | .30 | .46 | .25 | .30 | .30 | .20 | .46 | 1.00 |
| q | Fine hammered(6-cut) face dress'g | 9,000 " " | .75 | .70 | .40 | .75 | .60 | .70 | .60 | .45 | .70 | 1.00 | .65 | .60 | .60 | .75 | .75 | .60 | .60 | .60 | .75 |
| r | Rough pointed face dressing | 12,000 " " | .50 | .50 | .25 | .25 | .50 | .50 | .55 | .35 | .50 | .90 | .40 | .30 | .29 | .50 | .50 | .30 | .45 | .40 | .75 |
| s | [3]Add'l for mas. in Portland, 2 to 1 | 2,000 cu. yds. | .... | 1.335 | 1.125 | .975 | 1.05 | 1.05 | .96 | 1.05 | .90 | 1.20 | 1.05 | 1.20 | .741 | 1.20 | 1.50 | 1.17 | .975 | 1.20 | 1.35 |
| ss | [4]Add'l for mas. in Portland, 3 to 1 | 10,000 " " | .... | .89 | .75 | .65 | .70 | .70 | .64 | .70 | .60 | .80 | .70 | .80 | .494 | .80 | 1.00 | .78 | .65 | .80 | .90 |
| sss | [5]Add'l Portland, 2 to 1 instd 3 to 1, | 2,000 " " | .... | .445 | .375 | .325 | .35 | .35 | .32 | .35 | .30 | .40 | .35 | .40 | .247 | .40 | .50 | .39 | .325 | .40 | .45 |
| t | Wrought iron or steel | 50 tons | 80.00 | 70.00 | 150.00 | 70.00 | 100.00 | 70.00 | 80.00 | 100.00 | 100.00 | 80.00 | 85.00 | 120.00 | 51.75 | 100.00 | 100.00 | 100.00 | 70.00 | 50.00 | 125.00 |
| tt | Cast iron pipe | 3,300 " " | 27.00 | 35.00 | 35.00 | 30.00 | 25.00 | 30.00 | 30.00 | 30.00 | 28.00 | 30.00 | 27.00 | 48.00 | 34.50 | 30.00 | 30.00 | 26.00 | 28.00 | 38.00 | 60.00 |
| ttt | Special castings | 200 " " | 60.00 | 60.00 | 65.00 | 90.00 | 60.00 | 35.00 | 60.00 | 70.00 | 80.00 | 40.00 | 65.00 | 115.00 | 69.00 | 100.00 | 40.00 | 75.00 | 50.00 | 70.00 | 225.00 |
| u | Drain-pipe, 18-in. | 1,000 lin. ft. | 1.20 | 2.00 | .55 | 1.00 | 1.70 | 1.00 | .60 | 1.50 | 1.00 | 2.00 | 1.40 | 1.60 | 1.15 | 1.40 | 2.00 | 1.00 | .90 | 1.50 | 2.25 |
| uu | " " 12-in. | 1,000 " " | .80 | 1.75 | .30 | .60 | 1.25 | .75 | .40 | 1.30 | .60 | 1.50 | 1.00 | 1.10 | .58 | 1.00 | 1.50 | .80 | .45 | 1.00 | 1.25 |
| uuu | " " 8-in. | 1,000 " " | .60 | 1.50 | .20 | .40 | 1.00 | .50 | .30 | 1.00 | .40 | 1.00 | .75 | .70 | .35 | .75 | 1.25 | .60 | .35 | .80 | 1.00 |
| uuuu | " " 6-in. | 1,000 " " | .40 | 1.25 | .15 | .25 | .75 | .40 | .20 | .80 | .30 | .50 | .50 | .60 | .30 | .50 | 1.00 | .50 | .25 | .60 | .75 |

[1] Percentage prices, 4% of b. [2] 100 sq. ft. [3] Percentage prices, 30% of k. [4] Percentage prices, 20% of k. [5] Percentage prices, 10% of k.

## MISCELLANEOUS CONTRACTS AND SUPPLIES.

CEMENT.—New York, N. Y.—Bids are asked by the dock commissioners until July 30 for furnishing 8,000 bbls. of Portland cement.

WATER TOWER.—Chicago, Ill.—Bids are asked until July 22 for a 75-ft. water tower for the fire department. D. J. Swenie, Fire Marshal.

BROKEN STONE.—Syracuse, N. Y.—Bids are asked until July 22 for furnishing 300 cu. yds. of broken blue limestone. Henry C. Allen, Cy. Engr.

CRIB.—Syracuse, N. Y.—Bids are asked until July 22 for constructing a retaining crib and fence along the east bank of the Onondaga Creek. H. F. Stephens, Cy. Clk.

DREDGING.—Brooklyn, N. Y.—Bids are asked until July 30 for 463,000 cu. yds. of dredging on Wallabout Market lands, as stated in our advertising columns. Alfred T. White, Comr. Cy. Wks.

REMOVING WRECK.—Boston, Mass.—Bids are asked until July 25 for the removal of the wrecked steamship "Venetian," in Boston harbor, as stated in our advertising columns. Woodward Emery, Chn. Harbor Comrs.

BOILERS.—Erie, Pa.—Bids are asked until July 27 for boilers, boiler shed, etc. Arch., Thos P. Lonsdale, Fourth and Walnut Sts., Philadelphia. Address Louis Wagner, Chn., care of Maj. W. W. Tyson, Soldiers and Sailors' Home, Erie.

TRAMWAY AND DERRICK.—Detroit, Mich.—Bids are asked until Aug. 1 for furnishing the materials and labor of all kinds necessary for the complete construction, erection and delivery of buoy shed, platform, tramway, and derrick for lighthouse depot, St. Joseph, Mich. Maj. M. B. Adams, U. S. Lighthouse Engr.

QUAY WALL.—Brooklyn, N. Y.—Bids are asked until July 30 for the construction of quay wall inside of Whitney Basin and for reconstructing building No. 115 at the Brooklyn navy yard. An appropriation of $25,-

Works; also for constructing a dock and for deepening the channel in front of same at the Erie Basin, Buffalo; and also for protecting berme bank of Cayuga and Seneca Canal at foot of Seneca Lake. Plans and specifications have been approved for 50,400 cu. yds. of dredging from the Albany Basin and 3,500 cu. yds. from the West Troy Basin, and for repairing the dam across the Mohawk River at Rexford Flats. Geo. Aldridge, Supt. Pub. Wks.

## CONTRACT PRICES.

ASPHALT AND BRICK PAVING.—Lansing, Mich.—The following bids were received July 6 for paving Michigan Ave., as advertised in Engineering News; length, 1,920 ft.; width, 77½ ft.; quantities, 8,773 ft. Medina curbing, 3,910 ft. drain pipe, 7,400 cu. yds. excavation, 17,018 sq. yds. brick and concrete:

Paving with Brick.

| | |
|---|---|
| E. O. Sellers & Co., Lansing, Mich. | $30,825 |
| M. E. Fitzpatrick, Lansing, Mich. | 30,879 |
| J. T. Conn, Detroit, Mich. | 31,418 |
| Woodcock & Kneal, Lansing, Mich. | 31,678 |
| Peterson & Co., West Bay City, Mich. | 32,905 |
| Jenkinson & Nicholson, Port Huron, Mich. | 33,359 |
| Rogers Construction Co., Buffalo, N. Y. | 33,781 |

Paving with Asphalt.

| | |
|---|---|
| Mexican Asphalt Co., Chicago, Ill. | $35,141 |
| American Asphalt Co., Columbus, O. | 38,186 |
| Warren-Scharf Asphalt Co., N. Y. city | 38,286 |
| Western Bermudez Asphalt Co., Detroit, Mich. | 39,796 |
| Barber Asphalt Co., Buffalo, N. Y. | 48,749 |

The contract has not yet been awarded, as the question of material has not been decided; property owners are in favor of brick. E. O. Sellers, Supt. Pub. Wks.

SEWERS.—Scranton, Pa.—The following bids were opened in select council, July 11, for constructing the Farber Court lateral sewer, 1,140 ft., 24-in. terra cotta pipe, 5 manholes, 1 catchbasin, average depth about 7 ft.: Vincent H. O'Hara, city, $1.98 per ft. complete;

SEWERS.—Ithaca, N. Y.—Henry N. Ogden, Ch. Engr., writes us that the contract for constructing an outfall sewer, as advertised in Engineering News, has been awarded to Burns & Banks, at $19,303, their bid being about $5,000 lower than any received at a previous date for this work. The interesting point is the lake dredging. This was confined to 2,500 ft. at the shore end, water from 0 to 11 ft., and an average cutting of 2¼ ft., the cost being distributed over the entire 6,175 ft. Four bidders proposed dredging with regular dredge, at $3,700 to $2,900. T. F. Moore proposed a pump, at $864, and Burns & Banks propose a hand scraper, at $556. The bids were as follows:

| | Excavation.[1] | Dredging.[2] | Pipe l'g.[3] | Wood pipe.[4] |
|---|---|---|---|---|
| Burns & Banks, Niagara Falls | $1,201 | $556 | $6,122 | $11,424 |
| Thos. F. Moore, Buffalo | 989 | 864 | 6,781 | 11,115 |
| J. McCloud & Co., W'msport, Pa. | 969 | 1,544 | 6,587 | 10,683 |
| Acock & Son, Trenton, N. J. | 775 | 3,705 | 5,231 | 10,321 |
| Driscoll Bros. & Reed, Ithaca | 1,782 | 2,902 | 6,471 | 10,489 |
| Mich. Pipe Co., Bay City, Mich. | 542 | 2,161 | 4,611 | 14,573 |
| Jos. A. Barry, New York | 3,875 | 1,544 | 7,750 | 11,115 |
| Hingston, Dodge & McGregor, Bflo | 1,162 | 3,087 | 4,766 | 16,364 |
| C. E. Cornell, Ithaca | 2,092 | 3,087 | 7,169 | 13,894 |

[1] 3,875 ft. of excavation, 5-ft. trench. [2] 6,175 ft. of lake dredging, average cut 1 ft. 8 ins.; water, 0 to 30 ft. deep. [3] 3,875 ft. of 14-in. cast iron pipe, laid. [4] 6,175 ft. of 14-in. wood pipe, weighted to 95 lbs. per lin. ft.

DREDGING.—Philadelphia, Pa.—Joel Cook, Pres. Port Wardens, writes us that the contract for dredging docks has been awarded to the American Dredging Co., of Philadelphia, at 15 cts. per cu. yd. This was the only bid received.

SEWERS.—Bloomfield, N. J.—A. H. Olmsted, Engr., informs us that the bids received July 8 for constructing 7,233 ft. of 8-in. and 3,259 ft. of 20-in. pipe sewers, as advertised in Engineering News, were as follows, the contract being awarded to P. H. Harrison & Sons, as noted in our issue of July 11:

For bracing or sheet piling left in trench, $20 will be paid per M. ft., B. M.; for timber foundations, $20 will

be paid per M ft., B. M.; for rock excavation, $2 will be paid per cu. yd.; for concrete, $5 will be paid per cu. yd. Manholes will be measured from the under side of concrete to bottom of manhole head. Flush tanks must be plastered inside and outside with Portland cement of quality and thickness satisfactory to the engineer. Excavation below grade will be paid for at 30 cts. per cu. yd.

| Items. | Henry M. Dowd, Orange, N. J. | P. H. Harrison & Sons, Newark, N. J. | J. F. Murray and M. Condon, Newark, N. J. | Neff & Mitchell, Newark, N. J. | Robt. Brown, For Richmond, N. Y. |
|---|---|---|---|---|---|
| 8-in vit'fied pipe, lin. ft. | $0.39 | $0.45 | $0.63 | $0.43 | $0.79 |
| 20-in. " " " " | 1.81 | 2.00 | 3.25 | 2.48 | 4.48 |
| 6-in. Y or T brchs, 8-in. pipe | ... | .35 | .51 | 1.00 | .50 |
| 6-in. " " " 20-in. " | ... | 1.65 | 1.52 | 2.00 | 2.19 |
| Cast iron pipe, per ton[1] | 20.00 | 22.40 | 56.00 | 40.00 | 21.00 |
| Manholes, vert. ft., to 12 ft. | 1.65 | 2.00 | 3.50 | 2.00 | 2.00 |
| " " " over " | 2.00 | 3.00 | 2.00 | 2.50 | 3.25 |
| " single chimney[2] | ... | 1.00 | 1.00 | .35 | .10 |
| " double " [2] | ... | 2.00 | 2.00 | .70 | .17 |
| Junction manholes[3] | ... | 5.00 | 1.00 | .75 | 1.25 |
| Flush tanks complete[4] | 55.00 | 50.00 | 48.00 | 60.00 | 69.00 |
| Lampholes, per vertical foot | .10 | .25 | .75 | 1.00 | .90 |
| Manhole tops[5] | .01 | .01½ | .02 | .02 | .01¾ |
| Portland cem., ex. pr bbl.[7] | 3.00 | 1.00 | 3.00 | 2.20 | .... |
| W't iron manhole steps, lb. | .05 | .05 | .05 | .04 | .01 |
| 6-in. risers, per vert. ft. | .20 | .20 | .15 | .25 | .21 |
| Spcl riser tops, incl. plugs. | .60 | .75 | 2.00 | 1.50 | 1.30 |
| 6-in. underdrain, per lin. ft. | .15 | .50 | .75 | 2.00 | .90 |
| Piling, per lin. ft. | ... | .10 | .25 | .20 | 3.14 |

[1] Ton of 2,240 lbs. [2] Chimney connections as per plans, extra above regular price for manholes without chimney. [3] The double chimney connections as per plans, extra above regular price for manholes without chimney. [4] For each connection including one length of pipe, bulkheaded, above regular price bid for manholes. [5] With syphon as per plan. [6] Covers and other castings as shown on plans, per lb. [7] When ordered by the engineer in place of Rosendale.

SEWERS.—Dayton, O.—The following bids were received July 2 for constructing lateral sewers in district No. 1; W. M. Judd, Asst. Cy. Engr. in Charge of Sewers:

Bids for Constructing Lateral Sewers at Dayton, O.

| Quantities. | H. J. McGrath, Dayton, O. | W. H. Tanner, Dayton, O. | Richard Nash, Dayton, O. | O. W. Bailey, Dayton, O. | Munger Bros., Dayton, O. | P. E. Lehman, Dayton, O. | Bartow & Clements, Hamilton, O. | Ulrich, Nissly & Williams, Springfield, O. | David Beard, Dayton, O. | Ware & Moodie. | J. A. Lauterbach, Dayton, O. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8-in. pipe, per lin. ft. 3,200 ft. | $0.13½ | $0.14 | $0.14¾ | $0.14 | $0.16 | $0.16 | $0.16 | $0.15 | $0.14½ | $0.19 | $0.15 |
| Excavation and backfilling, per lin ft: | | | | | | | | | | | |
| 0 to 6 ft. deep 1,375 ft. | .11 | .15 | .14½ | .12½ | .15 | .15 | .22 | .15 | .25 | .16 | .14 |
| 6 " 8 " " 900 " | .18½ | .18 | .17 | .18 | .20 | .20 | .30 | .30 | .33 | .20 | .15 |
| 8 " 10 " " 475 " | .25½ | .25 | .24½ | .29 | .30 | .30 | .35 | .35 | .45 | .30 | .30 |
| 10 " 12 " " 275 " | .38 | .35 | .36 | .39 | .45 | .40 | .40 | .40 | .65 | .45 | .38 |
| 12 " 14 " " 125 " | .50 | .40 | .50 | .48 | .55 | .57 | .50 | .70 | .70 | .62 | .50 |
| 14 " 16 " " 50 " | .60 | .60 | .57 | .64 | .70 | .75 | .60 | 1.00 | 1.00 | 1.00 | .70 |
| Repaving, per sq. yd. 25 sq. yds. | 3.50 | 2.00 | 3.22 | 3.10 | 3.50 | 3.15 | 3.50 | .40 | 3.50 | 3.75 | 3.10 |
| Manholes, 6 each | 23.00 | 25.00 | 26.00 | 24.50 | 25.00 | 23.00 | 16.80 | 25.00 | 30.00 | 30.00 | 25.00 |
| Lampholes 11 " | 1.25 | 2.50 | 2.25 | 3.50 | 3.00 | 2.50 | 1.25 | 8.00 | 5.00 | 3.50 | 3.00 |
| Flush tanks 3 " | 23.00 | 25.00 | 24.75 | 29.00 | 30.00 | 23.00 | 25.00 | 40.00 | 35.00 | 35.00 | 33.00 |
| Lead pipe, per lin. ft. 30 ft. | .25 | .30 | .22 | .25 | .35 | .25 | .25 | .30 | ... | .28 | .30 |
| Cor. cocks, etc., 3 each | 9.00 | 5.00 | 7.00 | 7.80 | 6.00 | 8.00 | 8.00 | 3.00 | 4.50 | 7.50 | 8.00 |
| Total | $1,411 | $1,438 | $1,494 | $1,500 | $1,657 | $1,604 | $1,762 | $1,756 | $2,076 | $1,850 | $1,545 |

PAVING BRICK.—Wilmington, Del.—The bids for a supply of paving brick were published last week. Contracts have been awarded as follows: Doan Brick Co., Athens, O., 14,809 sq. yds., at 94 cts.; Bolen Brick Co., Zanesville, O., 8,067 sq. yds., at 89 cts.; Townsend Brick & Contracting Co., Zanesville, O., 5,045 sq. yds., at 99 cts.; Francis & Rauch, Pine Rock, Pa., 3,014 sq. yds., at 79 cts.

STEEL WATER TANK.—Cincinnati, O.—We are informed that the following bids were received July 9 for a steel water tank 40 ft. in diameter and 70 ft. high, at Mount Auburn, as advertised in Engineering News:

| | |
|---|---|
| Riter & Conley, Pittsburg, Pa. | $11,977 |
| Tippett & Wood, Phillipsburg, N. J. | 16,437 |
| Springfield Boiler Mfg. Co., Springfield, Ill. | *9,172 |
| Cincinnati Architectural Iron Wks. Co., O. | 10,420 |
| The L. Schreiber Sons Co., Cincinnati, O. | 9,555 |

* $8,975 with swinging scaffold; $8,751 with hand-driven rivets.

ASPHALT PAVING.—Scranton, Pa.—The only bid received July 11 for paving a portion of Clay Ave. with asphalt was that of the Barber Asphalt Paving Co., at $2.58 per sq. yd. for paving, 92 cts. per lin. ft. for circular curbing, 67 cts. for regulation curbing, 77 cts. for curbing and drain tile, and 22 cts. for resetting curbing. Joseph B. Phillips, Cy. Engr.

DRIVING PILES.—Sioux City, Ia.—Capt. H. F. Hodges, U. S. Engr. Office, informs us that the following bids were received and opened on July 6 for driving piles at this place:

| | Per lin. ft. |
|---|---|
| Geo. Adgate, Sioux City, Ia. | $.0975 |
| Henry Hall, Florence, Neb. | .19 |
| Alfred A. Raymond, Omaha, Neb. | .109 |
| C. E. H. Campbell, Council Bluffs, Ia. | .15 |
| Goodrich & Robson, Sioux City, Ia. | .084 |

BRICK PAVING.—Washington, Pa.—James A. Wiley writes us that the contract for paving East Washington St. with brick has been awarded to A. T. Hallam & Sons, of Washington, Pa., at $1.31 per sq. yd., including grading.

GRANITE BLOCK PAVING.—New York, N. Y.—The contract for paving Webster Ave. with granite blocks has been awarded by Louis F. Haffen, Comr., 2622 Third Ave., to John G. Smith, the lowest bidder; time, 200 days; security, $100,000. The bids were as follows:

| | Granite blocks, 78,000 sq. yds. | Bridge stone, 10,800 sq. ft | Total. |
|---|---|---|---|
| M. Fitzgerald | $1.98 | $0.40 | $159,948 |
| M. Baird | 2.10 | 0.50 | 170,460 |
| J. G. Smith | 1.95 | 0.40 | 157,590 |
| M. J. Leahy | 2.53 | 0.47 | 203,934 |
| Thilemann & Smith | 2.09 | 0.35 | 168,054 |
| P. J. Kelley | 1.98 | 0.45 | 160,488 |
| D. Moran | 2.04 | 0.35 | 164,124 |

## INDUSTRIAL NOTES.

THE LACONIA CAR CO., of Laconia, N. H., has an order for 600 freight cars.

THE DUNBAR FURNACE CO., of Dunbar, Pa., will put in 100 Semet-Solvay by-product coke ovens this season.

THE ILLINOIS STEEL CO., of Chicago, Ill., will build new furnaces and double the capacity of its open-hearth plant.

ORR BROTHERS, contractors, of Catskill, N. Y., are carrying out paving contracts at Poughkeepsie, Newburg and Catskill.

THE COLE MFG. CO., of Lakeport, N. H., has the contract for 2,400 axles for 600 freight cars which the Laconia Car Co. is building.

THE MICHIGAN PIPE CO., of Bay City, Mich., reports that it has contracts for pipe for the waterworks of Standish, Mich., and Paxtang, Pa.

THE MARYLAND STEEL WORKS, of Sparrow's Point, Md., will probably resume work in the rolling mill and other departments in a few weeks.

THE CHICAGO PNEUMATIC STEEL WAREHOUSE CO., of Chicago, Ill., will erect a grain storage plant at Washington Heights, consisting of vertical steel cylindrical tanks.

THE FULTON BOILER WORKS, of Richmond, Ind., has the contract for 24 boilers of 100 HP., three iron smokestacks and two condensing tanks for the Indiana Distilling Co., of Terre Haute, Ind.

THE UNITED STATES WIND ENGINE & PUMP CO., of Batavia, Ill., has recently been awarded the contract for putting in complete systems of water supply at Freeburg, Ill.; Memphis, Mo., and Deerfield, Wis.

HEALEY, TIBETTS & CO., of San Francisco, Cal., have the contract for a single-track drawspan of 180 ft. for the San Francisco & San Joaquin Valley R. R. Chief Engr., W. B. Storey, Jr., 231 Market St., San Francsico. The Pittsburg Bridge Co. will furnish the superstructure.

THE BELKNAP MOTOR CO., of Portland, Me., has equipped the steamers "Bay State" and "Portland," of the Portland Steam Packet Co., and the "St. Croix," of the International Steamship Co., with electric lighting plants, consisting of Belknap multipolar dynamos direct coupled to Ideal steam engines.

THE CEDAR RAPIDS PUMP CO., of Cedar Rapids, Ia., has enlarged its factory and put in a new engine and boiler. It is introducing an arrangement patented by L. A. Rich, Superintendent, by which a valve may be put in and taken out of the pump stock without removing the stock from the well.

FR. VON EMPERGER, consulting engineer, 71 Broadway, New York, informs us that the 70-ft. span Melan bridge built by him in Eden Park, Cincinnati, O., was recently tested by the city with a 15-ton steam roller, before the asphalt roadway was laid, and that the test showed not the slightest movement or deflection in the structure.

THE BROWN-BONNELL IRON CO., of Youngstown, O., is remodeling the blast furnace at Struthers, with the intention of having it put in blast at the earliest possible moment. The large orders received have necessitated running the mills double time, and the product of the Phoenix furnace, adjoining the mills, is not sufficient to supply all the pig iron required.

THE PITTSBURG BRIDGE CO., of Pittsburg, Pa., has a contract from the Northern Pacific R. R. to replace the Greenhorn and Austin Gulch timber trestles with modern steel viaducts. Both are on 10° curves and grades of 85 ft. to the mile. The tower spans will be 31 ft., connected by intermediate plate-girder spans of from 30 to 60 ft. The Greenhorn Gulch viaduct will be 579 ft. long and will weigh 769,000 lbs. The Austin Gulch viaduct will be 493 ft. long and will weigh 683,000 lbs.

THE CATSKILL SHALE BRICK & PAVING CO., of Catskill, N. Y., has its plant nearly completed. There will be a main building 138×90 ft., two Penfield brick machines, each with a daily capacity of 50,000 brick; ten Endaly down-draft kilns, each holding 200,000 brick, and a down-draft Penfield dryer. The plant will be designed to turn out 100,000 brick per day. Pres. and Gen. Man., R. C. Penfield, Willoughby, O.; Supt., A. Stewart, Brady's Run, Pa.; Secy., John F. Harris, Jr., Catskill, N. Y.

THE REPLOGLE GOVERNOR WORKS, of Akron, O., has been organized by parties interested in the Selle Gear Co., and will be in charge of Mark A. Replogle, for the manufacture of the Replogle electric governor for water wheels. This governor consists of a gate regulator, a high-speed engine governor and an electric battery, so arranged that the battery operates the gate according to the speed of the governor. It is in use on water power electric lighting plants at Elkhart, Ind.; Burlington, Vt.; Niagara Falls and Ithaca, N. Y.

THE UNITED STATES CAR CO., 45 Broadway, New York city, has issued a statement from the London office to the effect that the payment of the coupons on the first mortgage bonds will be deferred, in consequence of the continued depression in the car building trade, but that there are indications of a coming demand and a return to normal business conditions. The various plants at Chicago, Anniston, New Decatur and Urbana are in a fair state of efficiency. Work at the first-named shop is being carried out to a small extent on a contract for furniture and box cars. The Urbana shop has been kept running on repair work, for the moment very light, and may be expected to meet its expenses. G. W. Ristine, Receiver of the Colorado Midland Ry., has been appointed a director. Pres., David Cornfoot; Vice-Pres., Thomas Sturgis.

THE NATIONAL SWITCH & SIGNAL CO., of Easton, Pa., has acquired the property of the Johnson Railroad Signal Co., of Rahway, N. J., including real estate, buildings, machinery, materials, patents and goodwill, all this property having been sold by the Chancellor of New Jersey. The acquisition of this property not only materially increases the capacity of the National company, but gives it a broader range of work; for with the purchase of the several patents of the Johnson company, it now controls a large field, and can furnish both types of interlocking machines as well as the Webb & Thompson train staff, the Patenall lock-and-block, and other valuable devices. After the organization of the National company the first step of the new management was to commence the erection of new buildings on its property in Easton, and at the same time the superintendent of the works was directed to prepare a complete set of jigs and dies for all apparatus, and to make all parts interchangeable before further orders were filled. The company states that in spite of the general depression in business, the demand for its product has increased steadily until it was necessary to operate double shifts during the last three months. Additional machinery was put in, and now with the additional works secured by the purchase of the Johnson plant, the capacity of this company has been increased from the smallest to the largest signal works in the United States. The works at Rahway were opened with full force July 15. Aaron Dean, Jr., has been appointed Eastern Agent with offices at 32 Liberty St., New York, and Mr. T. H. Patenall has been appointed Chief Electrician, and will take charge of the works at Rahway.

NEW COMPANIES.—Eastern New York Hedge & Wire Fence Co., Fort Plain, N. Y.; $110,000; J. Harvey Smith, John D. Wendall and Dr. Douglas Ayres.

California Wrench Co., San Francisco, Cal.; $200,000; John D. McKee, W. C. Murphy and A. J. Meyer.

Texas Channel & Dock Co., Aransas Pass, Tex.; $1,000,000; W. A. Stedeman, T. B. Wheeler and J. F. Cooper.

Edwards Automatic Car Fender Co., Brooklyn, N. Y.; $100,000; Patrick J. Carlin, Joseph H. Cuyler and John Barnes.

Standard Railway & Farm Fence Co., Joliet, Ill.; $100,000; Wm. B. Ridgeley, Charles Fetzer and Geo. J. Bellsheim.

Corpus Christi Direct Channel & Dock Co., Corpus Christi, Tex.; $1,000,000; C. C. Heath, J. W. Ward and G. R. Scott.

New York Roller Bearing Fifth-Wheel Co., New York, N. Y.; $25,000; Charles A. Stadler, H. M. Hoar and Wm. Gaskel.

Pacific General Engineering Co., Portland, Ore.; $100,000; Douglas W. Taylor, Philip G. Eastwick and Sanderson Reed.

Big Horn Gold Mining Co., Los Angeles, Cal., $2,000,000, with $1,438,000 paid in; L. W. Blinn, S. M. Ross and F. L. Moore.

Horton Zinc Mining Co., St. Louis, Mo.; $60,000, all paid in; Monroe Horton, Charles J. Obermeyer and Henry A. Johann.

Western Republic Construction Co., Chicago, Ill.; $1,000,000; Charles R. Webster, John F. Spohn and George L. Harkness.

Tubular Heating & Ventilating Co., Philadelphia, Pa.; $5,000, with $500 paid in; Harry L. Davis, 2117 North 18th St., Philadelphia.

Eclipse Coupler Co., St. Louis, Mo.; $5,000, with $2,500 paid in; pipe coupling; J. G. Chouteau, J. B. Dockery and C. B. Hinsman.


## RESULTS OF A TRIAL.

Sterling, Ill., June 17, 1895.

Engineering News Publishing Co.,
Tribune Building, New York City.

Gentlemen:

I enclose list of bids received June 13 for the West Broadway sewer. In this connection I beg leave to inform you that our city realized this time as never before the benefits of advertising its work in the Engineering News. We did not advertise for bids in any paper except the News, and had time for but one insertion in that, and yet I received 112 applications for specifications, and we received 17 bids, while twice that number of bidders were on the ground.

Yours truly,

J. F. Barrett, City Clerk.

MORE THAN 150 REPLIES were received, an engineer writes us, from a recent insertion of a water-works advertisement in Engineering News.

ENGINEERING NEWS PRINTS MORE reliable news items, a larger number of proposal advertisements, and is much more extensively read by contractors and manufacturers of contractors' supplies than any other paper in America. These facts should be borne in mind. They may save you or your city large sums of money on contracts.